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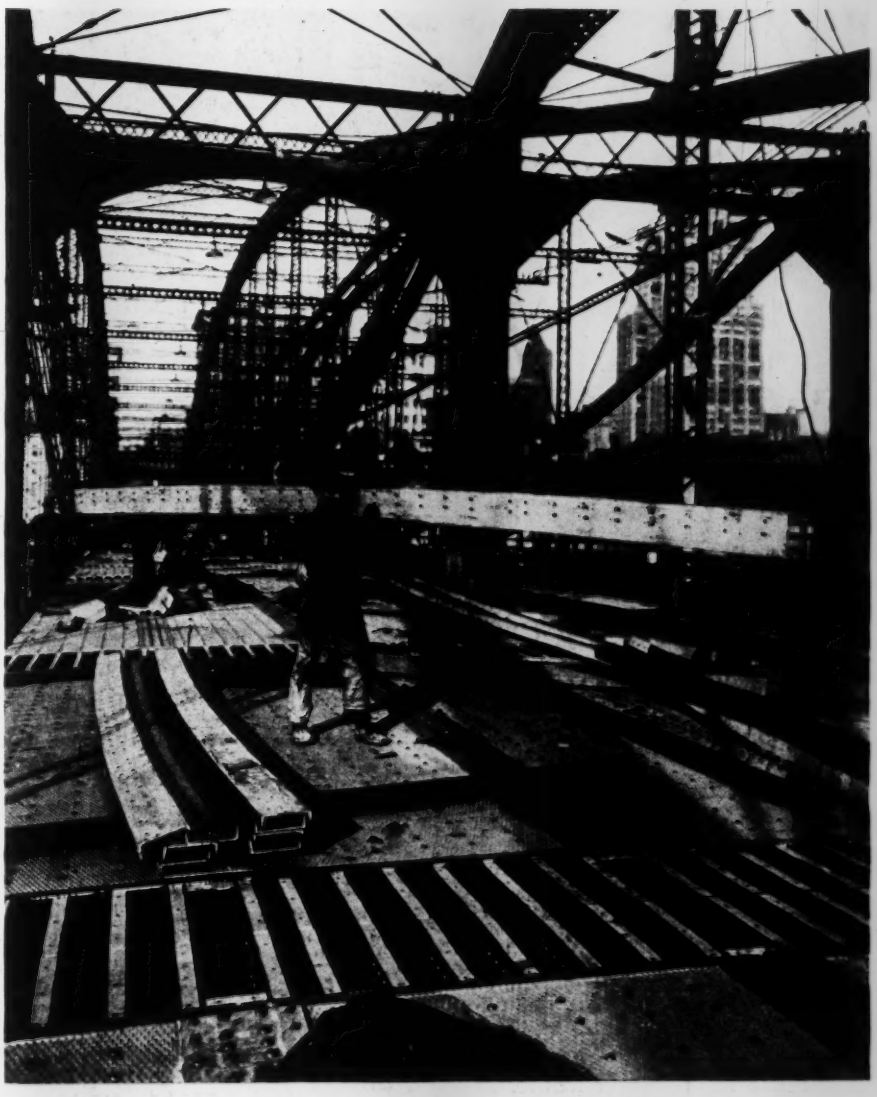

Aluminum Enters the Bridge Field

THE FIRST APPLICATION OF ALUMINUM to bridge construction has just been completed at Pittsburgh, Pa., where a new floor, including beams, stringers and deck, built entirely of aluminum alloy has been placed on the 51-year old Smithfield St. Bridge over the Monongahela River. A substantial dead load reduction permitted an increase in the safe live load, adding some 25 years to the useful life of the structure. Design and fabrication departed in no way from orthodox structural practice. Erection was facilitated by the light weight of the members as indicated in the above view of the novel deck.

BY ITS USE ON A MAJOR BRIDGE structural aluminum assumes added importance as a general utility material for the engineer. The story of the Smithfield St. Bridge job is told in this issue by Charles M. Reppert, Chief Engineer of the Department of Public Works of Pittsburgh.

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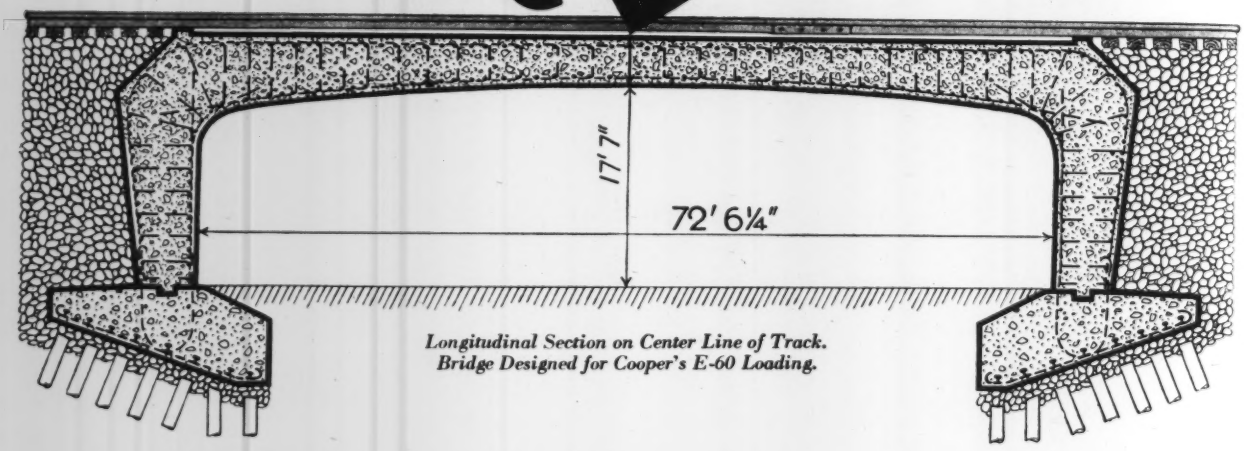

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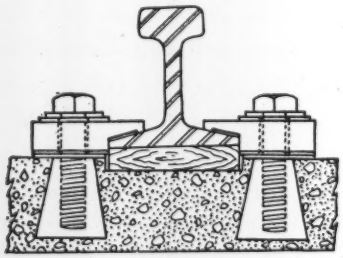

The bridge shown above in simple diagrammatic section is now under construction by the Canadian National Railways near Vaudreuil, Quebec. It is a double-track bridge on a skew crossing and on a curve. Built half-at-a-time, maintaining traffic on one track. No ballast or ties are used. Instead, the rails are fastened to the concrete deck with a cushion block of oak beneath the rails.

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Aluminum Enters Bridge Construction

Historic Smithfield Street Bridge in Pittsburgh has been reconstructed for longer life by removing its old steel and timber floor and placing a new floor of high-strength aluminum alloy

By Charles M. Reppert

Chief Engineer, Department of Public Works, Pittsburgh, Pa.

FIRST application of aluminum to bridge construction has just been accomplished at Pittsburgh, Pa., where the Smithfield St. Bridge, principal crossing of the Monongahela River since its construction in 1882, has been reconstructed by building a new floor of high-strength aluminum alloy in place of the old steel and timber floor. The purpose of the reconstruction was primarily to lighten the dead load in order to make it possible to continue the bridge in service safely.

In this work the entire floor system of the bridge was reconstructed using aluminum alloy members designed and built quite like steel members. No unusual conditions were encountered in either design, fabrication or erection, and the construction procedure throughout was quite closely the same as followed in comparable steel work. The heavy timber floor of the old roadway was replaced with a battledeck type of floor constructed wholly of aluminum and topped with an asphaltic surfacing. This deck slab, whose design was developed by the Aluminum Company of America and checked by extended service tests, weighs, together with the asphaltic surfacing, only 30 lb. per sq.ft.

The Smithfield St. Bridge has been a continuing problem for many years. Its age of 51 years combined with the fact that it has been carrying heavier loads than intended, on both the streetcar and the vehicle roadways, led eight or ten years ago to recommendations for the replacement of the entire structure. It was then thought that while the bridge could be maintained for a few years, its early replacement was inevitable, and in consequence all except the most necessary maintenance work was discontinued. At the same time the wooden floor was not only a large item of maintenance expense but furnished an unsatisfactory roadway surface and constituted a fire hazard.

Fig. 1—By taking some 700 tons of dead weight from the load carried by its trusses, the old Smithfield St. Bridge in Pittsburgh, considered obsolete, was made capable of serving traffic for many years to come. The inherent lightness of aluminum and saving in deck weight through a novel ribbed slab of metal were prime factors in weight reduction.

Replacement of the bridge by a new sturcture was considered essential at that time also because the bridge was inadequate for traffic and was expected to become even more inadequate as time went on. Subsequently, however, the building of the new Liberty Bridge and Tunnel route and the modernization of the Point Bridge and the South Tenth St. Bridge (respectively below and above the Smithfield St. Bridge) rendered the structure less important to through traffic. Smithfield St. Bridge thus tended increasingly to become a local facility in respect to vehicular traffic, although as a street-railway bridge it still maintained the position of being an essential link in the city's transportation system.

Under these circumstances, some strengthening of the trusses of the bridge was carried out in 1928, and last year a careful restudy of the whole situation was carried out with

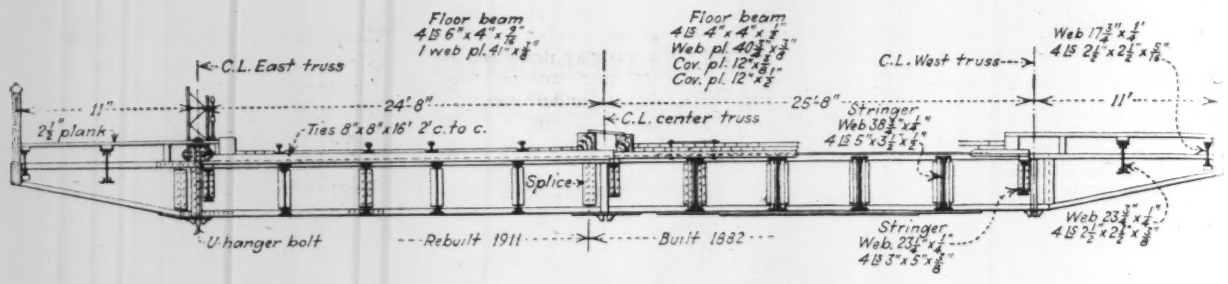


Fig. 2—Old wrought-iron and steel floor, with 11-in. timber decking for vehicle roadway.

a view to developing a plan by which the dead load on the bridge could be reduced and the structure thereby safely continued in service. The desired improvement was also intended to provide a better roadway surface, decrease maintenance expense and remove the ever-present fire hazard.

After various preliminary designs had been developed, the possibility that structural aluminum alloy might offer a solution was taken up, and it was found that through this material not only could the overstressing of the trusses be relieved but a permanent hard-surfaced roadway floor could be provided that would assure satisfactory service of the structure for many years. From the economic standpoint, deferring the replacement of the structure over a period of years would still mean a large net saving to the city after taking into account the cost of the floor reconstruction. On this showing it was decided to adopt an all-aluminum floor system.

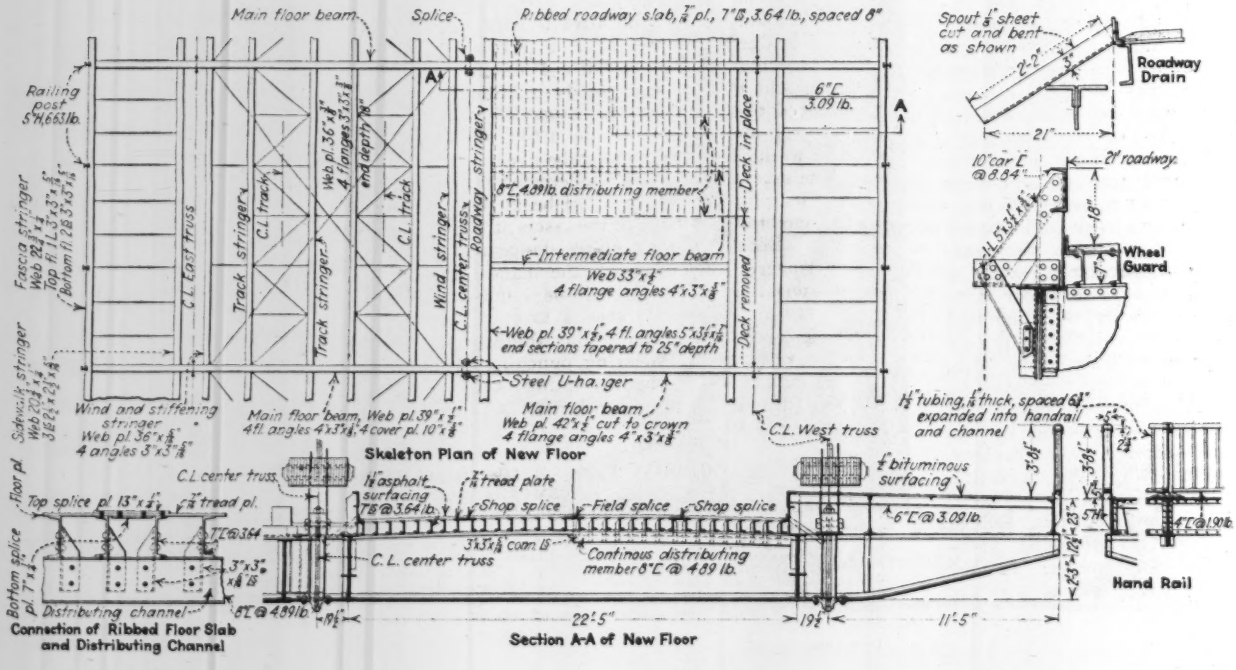
The old structure

The Smithfield St. Bridge spans the Monongahela River in a north-south direction at a strategic central location in downtown Pittsburgh. The present structure, designed by Gustav Lindenthal and erected in 1882, replaces the first suspension road bridge of John A. Roebling. It is the third bridge across the river at this point—the first, a covered wooden bridge, having been built more than 100 years ago. Mr. Lindenthal's own description of the bridge ("Rebuilding of the Monongahela Bridge at Pittsburgh," *Trans.*, Am. Soc. C.E., 1883, pp. 353-392) may be consulted for detail, but in general the present bridge as built consisted of two identical spans, each 360 ft. long, of two Pauli or double elliptical trusses spaced 25 ft. 8 in. on centers, carrying a roadway suspended below the trusses by pin-connected hangers. Both steel and wrought iron were used in the construction of the bridge, the use of steel at that time being a distinct innovation.

A third truss was added to each span in 1890, 20 ft. 8 in. upstream from the existing bridge, to provide a second roadway; the piers had been built long enough at the time of original construction to provide for the addition. At first one street-car track was placed on each side of the middle truss, but in 1911 the new (upstream or east) truss was moved 4½ ft. farther upstream, widening the second roadway to 24 ft. 8 in. between truss centers, so that both street-car tracks could be placed on the east roadway and the west roadway kept free for highway traffic. At that time also (1911) the present floor system was installed under the street-car tracks, while the floor system of the west or downstream roadway remained the same as in 1882 except for repairs and occasional replacements.

Briefly, the highway floor system consisted of wrought-iron plate-girder floor beams and six longitudinal stringers, supporting a laminated timber floor 11 in. thick, surfaced with two rows of steel traffic plates on each of the two traffic lanes. The floor system of the east roadway consisted of floor beams

Fig. 3—Aluminum-alloy floor framing and ribbed slab surfaced with asphaltic concrete reduce the dead load of Smithfield St. Bridge by more than 1 ton per lin.ft.



and four lines of stringers, and the track ties rested directly on the stringers. Sidewalks, bracketed out on both sides of the bridge, were floored with a single layer of 2-in. plank.

Reinforcement to reduce high stresses

A careful analysis of the stresses in the bridge was made in 1926; it showed that the east and center trusses were stressed to a point regarded as excessive, considering the age of the bridge. In 1928, therefore, additional steel bars were welded to the face of the outside eyebars of the upstream and center trusses, with the effect of reducing the live-load stresses somewhat, though having no appreciable effect on dead-load stresses.

Examination of the bridge in 1932 revealed the necessity for numerous repairs to the main stringers, trusses and floor system, including renewal of the wooden floor and the repair or replacement of the street-railway stringers. Because of the magnitude of the necessary repairs and the increasing fire hazard in the wooden floor, a study of alternate types of floor was undertaken. Concurrently there was developed the idea of reducing the dead load on the structure in order to decrease the stresses in the main members of the trusses and thereby prolong the useful life of the structure. Although the bridge was then 50 years old, it did not seem to have deteriorated unduly in its essential structure.

In this situation, attention was directed to a comparatively new material, structural aluminum alloy. Structural shapes and plates of this material had been used in railway cars, trucks and buses, dirigibles and airplanes, overhead traveling cranes and dragline booms for a number of years, but never as a major part of a bridge. Nevertheless, the fact that structural aluminum could be obtained with strength characteristics equal to those of structural steel, but at a saving of 65 per cent in weight, made possible the design of a floor system which, according to best judgment, would add some 25 years to the life of the bridge—in other words to the limit of safe prediction from the traffic standpoint. Considered in another way, the reduction of dead load would justify an increase of live load without exceeding present stresses and would allow certain existing restrictions on traffic to be removed.

New floor designed like steelwork

In general, the design of the aluminum floor beams and stringers is similar to that of corresponding steel members, except that more attention than usual was given to saving material. The floor beams, 39 in. deep in the street-car roadway and 42 in. deep under the crown of the vehicle roadway, are spliced just east of the center truss, as were the old floor beams, to facilitate erection without interrupting the street-car service, as the car tracks were shifted to the vehicle roadway during replacement of the railway floor system. On the street-car side there are four load-carrying stringers, one under each rail, and two side stringers serving as wind chords, all 36 in. deep. The track stringers are reduced in depth toward the end by bending the bottom flange upward from the middle bracing panel, in order to save weight.

The floor system of the highway side of the bridge consists of a $\frac{7}{16}$-in. treadplate as decking, supported by 7-in. channel joists spaced 8 in. on centers, which joists rest on intermediate and main floor beams. The effective span of the joists is 9 ft. $2\frac{1}{2}$ in. At the middle of each of these joist spans, a transverse 8-in. channel is rigidly attached to each of the joists as a distributing member, to cause several joists to cooperate in carrying a wheel load and thus give to the entire floor system the action of a deep slab. The arrangement of the supporting framing and the construction of the slab floor are shown in Fig. 3. A pavement or surfacing of cold-laid asphaltic mixture, $1\frac{1}{2}$ in. thick, forms the wearing surface of the roadway; the projections of the aluminum deck plate provide an anchorage to prevent the surface material from creeping under traffic.

Like the roadway, the sidewalks are carried by aluminum-alloy framing and decking. The surface is $\frac{1}{2}$ in. of cold-processed asphaltic paving on a smooth $\frac{1}{4}$-in. aluminum-alloy plate reinforced by 2x2-in. angles riveted to the under surface. This plate is supported by 6-in. channels resting on plate-girder stringers which, in turn, rest on extensions of the main floor beams outside the trusses. The sidewalk hand-rail also is of aluminum alloy, but of a different composition from that of the floor material, to give higher corrosion resistance. Its design adds materially to the attractiveness of the bridge. The top rail is oval tubing 5 in. wide, the bottom rail a 4-in. channel, and the balusters of $1\frac{1}{2}$-in. tubing spaced $6\frac{3}{4}$-in. on centers, expanded into the top and bottom rails by a tool similar to the ordinary boiler-tube expander. The assembled railing was erected in 9-ft. lengths, between 5-in. H-beam posts riveted to the outside of the fascia stringers. Because of the high resistance to atmospheric corrosion of the hand-rail material, no painting will be required.

Hot-driven steel rivets, $\frac{5}{8}$ to $\frac{7}{8}$ in. in size, were used throughout the work. The operation of shearing, punching and reaming in the shop, riveting, fitting and drawing together with drift pins in the field, etc., involved no methods or problems essentially different from those of steel bridge work. Reaming required only the lightest air tools on the market. While the aluminum alloy on the floor system is more resistant to corrosion than the steel or wrought iron which it replaced, nevertheless all the structural members are painted with a priming coat of iron oxide and zinc chromate paint covered with two field coats of aluminum paint.

Fig. 4—The aluminum roadway floor ready for surfacing.

Material and stresses

The physical properties of the aluminum alloys employed in the reconstruction of the Smithfield St. Bridge are given in the accompanying table. For a number of years the Aluminum Company of America has been experimenting with and developing a new structural alloy, commercially designated as 27 ST. After the design had been developed on 17 ST, but before work had actually begun, this new alloy was made available to the trade. In addition to its superior physical properties, it is more resistant to corrosion than is 17 ST. It also possesses other properties that make it particularly adaptable for structural work. It was, therefore, substituted for 17 ST but without changing the design.

The design of the floor system was based on the use of the strong aluminum alloy, 17 ST. The design stress was fixed at 15,000 lb. per sq.in. in tension and

PHYSICAL PROPERTIES OF ALUMINUM ALLOYS USED ON SMITHFIELD ST. BRIDGE

Alloy	4 SH	53 ST	27 ST	17 ST
Ultimate strength	42,000	36,000	60,000	58,000
Yield point	38,000	30,000	50,000	35,000
Elongation in 2 in.	3	12	12	20
Brinell hardness	80	80	118	100
Where used	Tubing for hand-rail	Rolled shapes for hand-rail	All floor members	Basis of design

compression. The stress on compression members was reduced for unsupported lengths according to formulas which take into account the modulus of elasticity of the material but are otherwise similar to those customarily used in steel design.

The maximum deflections in the floor system of the Smithfield St. Bridge are limited as follows: floor beams, 1/400 of span; stringers, 1/600 of span; roadway deck, 1/500 of span; and sidewalk deck plate, 1/100 of span. These conservative deflections result in stresses less than the permissible design stress in certain of the members.

Floor slab under load test

As already stated, the ribbed floor slab was originally designed by the Aluminum Company of America, but before it was proposed for use in the Smithfield St. Bridge it was subjected to extended load test. A panel of ribbed floor slab, 13 ft. 10 in. by 11 ft., was built over a masonry pit in a heavily traveled truck driveway and tested under H-20 loading.

Stresses and deflections in all parts of the structure were accurately measured. These tests resulted in the substitution of 7-in. channels, spaced 8 in. on centers, for 8-in. channels, spaced 11 in. on centers. The remarkable effectiveness of the transverse 8-in. channel in distributing concentrated loads over a number of the longitudinal channels and preventing differential deflections was well demonstrated by the test.

Results obtained by reconstruction

The extent to which dead load and stresses were reduced is shown in the following data:

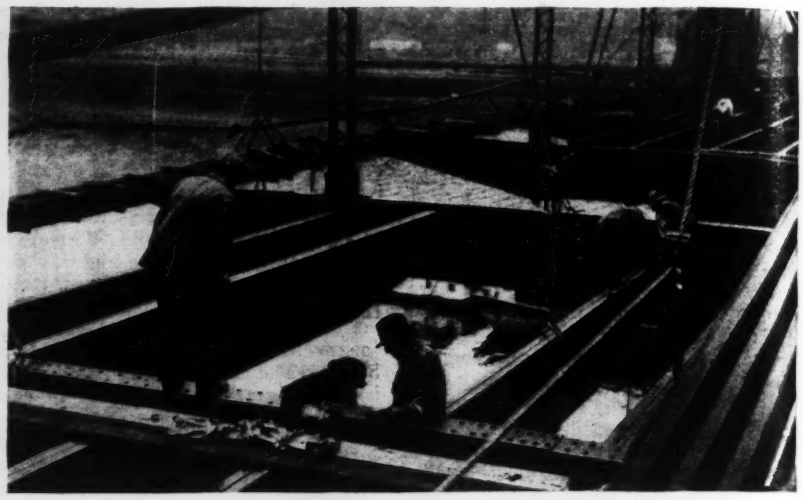
Combined panel load on 3 trusses of the floor system and floor removed, lb.	119,153
Combined panel load of new system, lb.	61,350
Reduction in weight per panel, lb.	57,803 (28.9 tons)

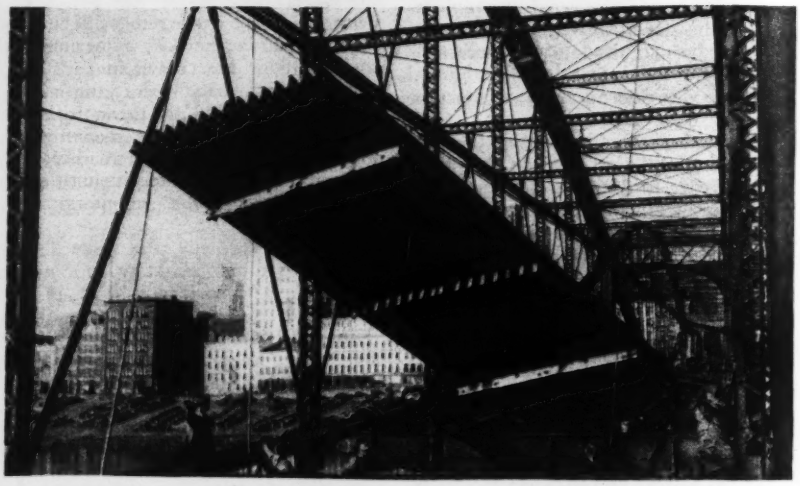
There being 26 panels in the bridge (two spans), the total reduction in weight was 751.4 tons, or a little over 1 ton per linear foot of the bridge.

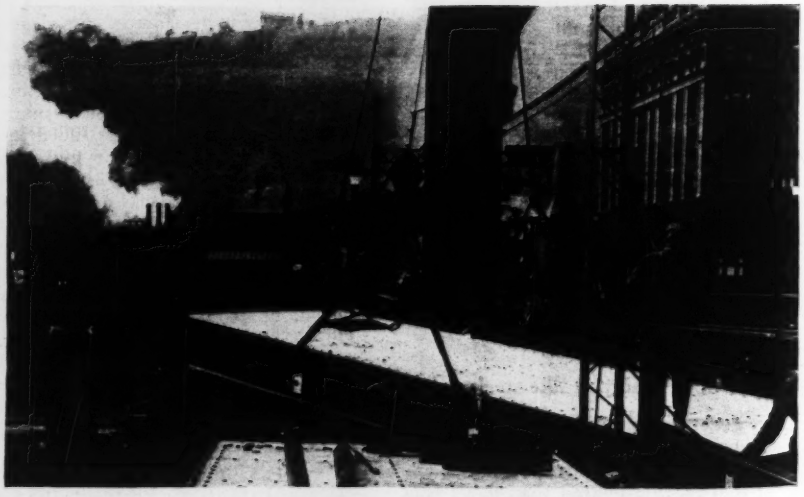
The panel load of the new system is subdivided as follows:

Aluminum, lb.	26,200
Steel rivets, lb.	3,000
Other steel, lb.	400
Total metal, lb.	29,600
Sidewalk surfacing, lb.	3,000
Roadway surfacing, lb.	9,000
Railway track structure, lb.	19,750
Total weight, lb.	61,350

With regard to the permissible loading on the bridge, vehicular loads have been limited to vehicles of 13 tons on four wheels prior to the reconstruction. The new floor has been designed to carry 20 ton trucks on four wheels. With regard to the street-railway side, the type of car in general use weighs from 66,000 to 70,000 lb. Prior to the reconstruction, a regulation has been enforced requiring an interval of 50 ft. to be preserved between street-cars operating over the bridge. With the reconstructed floor, this required spacing can be reduced or perhaps entirely eliminated. The floor system is designed for occasional cars weighing 90,000 lb., since the street railway company has actually operated such







Figs. 5, 6 and 7—As the upper view shows, erection of the new aluminum railway floor was much the same as steel erection. However, the light weight of the material facilitated operations. Fully assembled panels of the ribbed roadway slab (middle view) and of the sidewalk (lower view) could be set in place as single pieces.

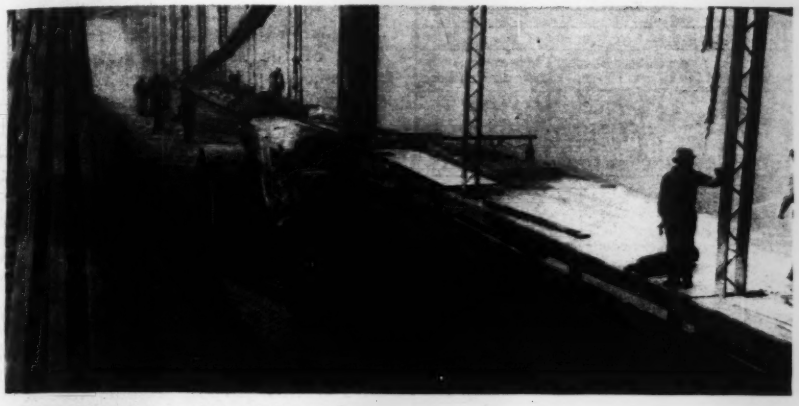


Fig. 8—Asphaltic surfacing laid on the roadway slab was compacted by rolling.

cars in the past and may find it necessary to do so again.

Cost and construction

Proposals for the floor reconstruction were received on July 12, 1933, and the contract was awarded to Walter S. Rae, of Pittsburgh, the subcontract for the fabricated structural aluminum to the Aluminum Company of America, and the fabrication itself to the Fort Pitt Bridge Works. The total contract price was $276,436, of which $192,000 was for the fabricated aluminum. The cost was covered by a ten-year 4¼ per cent serial bond issue of $300,000, whose ultimate cost to the city will be $370,125. This latter figure may be considered the total cost to the taxpayers of delaying for 25 years the building of a new bridge. As traffic conditions may change radically in the meantime, and the possible construction of a rapid-transit subway system would doubtless affect any bridge plan, the present estimate of the cost of the new bridge under conditions of today might be placed at $1,250,000. These bonds, if of the type sold for the reconstruction work but extending over a period of 25 years, would cost the city $1,935,000. The taxpayer has therefore saved by the adoption of the aluminum floor system the sum of $1,564,875, or more than the estimated first cost of the new bridge.

The contract provided that construction be carried on under a schedule limiting the diversion of vehicular traffic to a period of 24 days. Pedestrian and street-car traffic had to be maintained throughout this period. All work was done according to a prearranged and planned program. The details of these operations will be described in another article to be published soon.

This improvement was made under the direction of Edward G. Lang, director, and the writer, as chief engineer of the department of public works of Pittsburgh. Ross M. Riegel is division engineer of bridges, and Henry D. Johnson, Jr., is engineer of construction. J. P. Growdon was in charge of the work for the Aluminum Company of America, and C. G. Schade, chief engineer, for the Fort Pitt Bridge Works, which handled the fabrication.

Efficiency of Aggregate Interlock in Concrete Roads

By Clifford Older

Consoer, Older & Quinlan, Consulting Engineers, Chicago, Ill.

THE TESTS described in the valuable article "Tests of Aggregate Interlock at Joints and Cracks," by A. C. Benkelman, which appeared in *Engineering News-Record*, Aug. 24, 1933, demonstrate the serious weakness in our concrete pavements that may prevail at unprotected transverse cracks and joints, and the prime need of devoting serious thought to ways and means for eliminating this weakness. There can be but little doubt that the tests show that when cracked slabs are held in close contact, aggregate interlock is adequate to effect as much load transfer as may be expected at any joint or crack. The question of just how close the contact must be, as well as other points involved, seem worthy of discussion.

Moving loads at joints and cracks

Mr. Benkelman used an 18,000-lb. load in his tests. At first sight this might seem to be unnecessarily large. However, when it is remembered that traffic loads are more or less suddenly applied to the edge of the slab on the far side of free joints, and that a suddenly applied load in the theoretical case is equivalent to double the static load, the magnitude of the test load no longer appears excessive and the seriousness of a lack of protection becomes evident.

V. L. Glover, engineer of materials, Illinois division of highways, in "Reports of Investigations" Vol. 1, p. 1, writes of suddenly applied loads at free joints as follows: "It was found from tests with a Liberty truck, conducted by the Illinois division of highways, that this type of load, within attainable speeds, has a maximum effect equal to the effect of a static load about 1.5 times as great as the wheel load, and indications are that this effect is maximum at a speed of about 14 miles per hour." Thus, at free joints and cracks the effect of an axle load of 16,000 lb. may be equivalent to a total static load of about 24,000 lb. applied at two places only about 5 ft. apart upon the edge of the far slab.

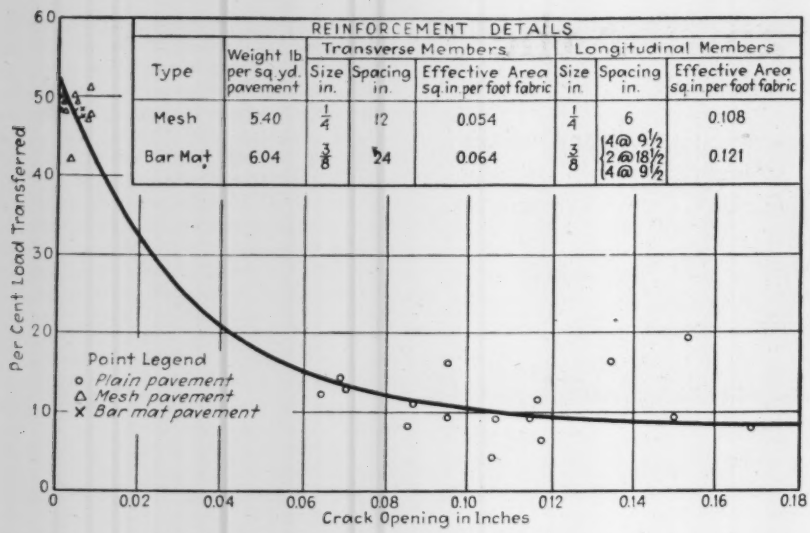
At efficiently doweled transverse joints and interlocked cracks not only is the 50 per cent increase (due to the sudden application) largely if not wholly eliminated, but also that part of the static load which each slab is called upon to bear is cut about in half. The effect of adequate provisions for load transfer is therefore approximately equivalent to a reduction of the load at transverse edges to about one-third of that which applies at free joints and cracks. Pavement designs that permit unprotected transverse joints and or cracks are therefore decidedly unbalanced, and much concrete is elsewhere wasted in order that these locations may be strong enough to support the loads that the pavements are called upon to bear.

The very great advantage of designs in which there can be no free joints or cracks would seem to be so obvious as to command far more attention than the scant amount that they have received to date.

Aspects of load transfer

It is obvious that any ordinary amount of longitudinal tie steel, used to prevent transverse cracks from widening, is in itself of no value as an agency for transmitting load. Its value depends upon its ability to hold the more or less roughly fractured concrete in close interlock. It is also obvious that after cracks have widened a certain amount (dependent upon the character of the fracture) there will be no load transfer at all.

Mr. Benkelman's Fig. 5 (reproduced herewith) indicates an apparent load transfer of about 10 per cent at cracks opened 0.07 in. or more. Searcy B. Slack's tests of a joint, from which all connecting material had been carefully removed, indicated a deflection of the unloaded slab amounting to about 10 per cent of that of the loaded slab. The



Relation of crack opening to per cent of load transferred.

small amount of load transfer indicated by Mr. Benkelman's Fig. 5 for cracks 0.07 in. or more in width may, therefore, represent no real load transfer by aggregate interlock. At any rate it would seem certain that tie steel, to be of any substantial value, must be able to prevent the slabs from separating more than perhaps one or two hundredths of an inch.

Mr. Benkelman's "special inspection" of mesh-reinforced pavements built in 1925 (eight years old), having transverse joints 100 ft. apart and longitudinal steel in amount sufficient to overcome subgrade friction only about 1.03 times the weight of the slab at 25,000 lb. stress in steel, disclosed cracks apparently 0.04 and 0.05 in. wide. An examination of Fig. 5 indicates this to be excessive for effective load transfer. The total width of the transverse cracks tested for load transfer was not given, although it may be inferred that those in reinforced pavements, which were only four years old, were not as wide as this.

In a mesh with welded transverse members 12 in. apart the crack spread must be accompanied by a corresponding elongation of the longitudinal steel in 12 in. of its length. In a 12-in. length the elastic elongation could not be more than about 0.015 in. With this in mind, the four to five hundredths of an inch found in the older pavements not only indicates a dangerous crack width as far as load transfer is concerned but unmistakably indicates that the steel had at some time been permanently elongated by a stress well beyond the highest yield point that could possibly have prevailed. This would strongly indicate a deficiency of longitudinal steel.

A careful consideration of conditions surrounding the contraction of pavement slabs under traffic indicates that an overstress of the tie steel, which may be sufficient to cause only a slight permanent elongation of the steel, is likely to be of but short duration, but it may be recurrent and may therefore eventually cause a serious widening of the crack. The fact that Mr. Benkelman did not find the tie steel ruptured by no means indicates that it had never been over stressed and permanently elongated at times of maximum friction drag.

Considering the fact that the steel must serve its purpose for twenty years or more, it is believed that it would be a serious mistake to reduce the area below that computed by assuming a coefficient of friction of 2, or 1½ at the very least, unless positive evidence is found that lesser amounts are safe over a long period of years.

Economical slab length

When longitudinal steel is proportioned to any subgrade friction coefficient, the economical slab length is quite definitely fixed by the relative cost of joints and tie steel in place. Arbitrary joint spacings are, therefore, likely to be costly. For all ordinary conditions the economical slab length will be much less than the 60 ft. suggested by Mr. Benkelman.

It is obvious that when tie steel is proportioned to subgrade friction, the cost of the steel required per unit of pavement length increases with the slab length. On the other hand, as the joint spacing increases, the cost of the joints per unit of pavement length decreases. Obviously, the economical slab length is that which results in the least cost of joints plus longitudinal steel per unit of pavement length. Relatively high-cost joints tend to increase the economical slab length. A specific example of how this works out in a given case may serve to illustrate the decided economy that may be effected by careful consideration of joint spacing.

For this purpose assume that for a 20-ft. pavement, expansion joints that provide a clear expansion space of 0 in. and a positive load transfer cost $10 each and are spaced at intervals of 120 ft. Assume that so-called contraction joints, which also provide positive load transfer, cost $5 each and are to be spaced at such intervals between expansion joints as may prove to be most economical. Assume also that the mesh used to provide tie steel throughout the pavement is proportioned to overcome subgrade friction when the coefficient of friction is 1½, that the working stress in the steel is 25,000 lb. per sq.in. and the pavement thickness is 7 in. Assume also that concrete weighs 150 lb. per cu.ft., and that the mesh in place costs 3½c. per lb.

Under these conditions the accompanying table shows the resultant cost of joints and tie steel for a 20-ft. roadway per unit of pavement length.

It thus appears that a joint spacing of 60 ft. would cost about $530 per mile more than a spacing of about 30 ft.

The amount of longitudinal steel suggested by Mr. Benkelman for 60-ft. slab lengths corresponds with that required by a coefficient of friction of about 1.2 if a working stress of 25,000 lb. per sq.in. is used. In this case and assuming the same prices as before, the economical slab length would be 30 to 36 ft. A 60-ft. spacing would cost about $340 per mile more.

The relatively short slabs that are practically certain to be most economical when tie steel is proportioned to subgrade friction have the further advantage of providing a large measure of transverse crack control. (For discussion of crack control, see "Crack Occurrence and Control in Concrete Pavement," *Engineering News-Record*, July 9, 1931, p. 50.)

It should not be forgotten that transverse cracks may make acute angles with the edges of the slab, thereby forming weak corners, and should be avoided in so far as may be practicable. The fact that public confidence is not inspired by cracks is also worth remembering.

It is to be hoped that the importance of the results of Mr. Benkelman's tests will not be overlooked.

COST OF JOINTS AND TIE STEEL PER UNIT OF PAVEMENT LENGTH

Slab Length, Ft.	Joints Per Foot	*Tie Steel Per Foot	Total Per Foot	Total Per Mile
60	$0.125	$0.367	$0.492	$2,598
40	0.167	0.245	0.412	2,175
30	0.208	0.184	0.392	2,070
24	0.250	0.147	0.397	2,096
20	0.292	0.122	0.414	2,186

*Longitudinal members only.

A Program for the Profession

Current movements to restrict practice tend to affect technical societies and colleges as well as the public—Is restriction or regulation the better course—Some challenging questions

By Dexter S. Kimball
Dean of the College of Engineering, Cornell University, Ithaca, N. Y.

WHETHER engineering practice is to be restricted or regulated is the most active question in engineering circles today. It is a question of obvious concern to the public, whom the profession serves, and to professional men themselves. But it is also a serious question for the technical societies and colleges, since these institutions would be profoundly affected if engineering should become a closed profession.

Regulations are old

The matters at issue are not new; both restriction and legal regulation of the practice of specific arts and professions are ancient devices. From time immemorial practitioners in the arts and professions have endeavored to exclude from their several callings all who were not qualified according to their established standards from participation in such occupations. The guilds of the middle ages were quite successful in their exclusiveness and often proved themselves of great value politically as well as industrially. For a long period of time they controlled the city republics of northern Italy during their golden age, and the political influence of the guilds of Central Europe is a story well worth reading.

Nor is the idea of legal regulation of industry by the state any new thing. The Code of Hammurabi, promulgated about 4,400 years ago in Babylonia, not only regulates the ordinary features of industrial relations but endeavors to control the law of supply and demand. Thus it states, "If a man hire a laborer from the beginning of the year until the fifth month, he shall pay 6 S.E. of silver per day; from the sixth month until the end of the year he shall pay 5 S.E. of silver per day"; and again, "If a man hire an artisan the wage of a brickmaker is 5 S.E. of silver; the wage of a carpenter is 4 S.E. of silver, etc., etc.,; so much per day shall he pay." The code does not state whether these be maximum wages; but if they are the latter, the minimum wages set by the NRA seem like an echo from the far-distant past. It would be interesting to know how Hammurabi succeeded with his edict. In the epilogue to the code he asserts that these laws are good for "all future time" and calls down the wrath of the gods upon those who alter or disobey his mandates. Again — how singularly modern it all sounds!

Present-day restrictive tendencies in the engineering profession thus have long precedent. Nevertheless, they are an independent development historically as well as in the conditions and methods involved. In the technical arts, at least, a long period passed without guild protection or other restrictive device.

It was unfortunate indeed that the old guilds had practically disappeared at the time of the Industrial Revolution and that there were no such protective influences existing among English workmen at that time. Naturally, also, no such organizations existed in this country at that period. Labor unions, which appeared in this country many years after the Industrial Revolution was well under way, differ radically from the old guilds, for the latter were combinations of employers and workers, while in labor unions as now existent labor and capital are arrayed against each other.

Modern industry, with little opposing influence of this kind, has developed as a highly capitalistic and highly individualistic structure. So long as there was open frontier, men could move away from uncongenial industrial conditions. But under the present crowded and highly competitive situations, with each and every one of us bound hard and fast to the industrial machine, the entire question of the management of industry is before us, with some of the old legislative methods of Hammurabi proposed as means of alleviation.

Now, engineering is the backbone of all industry, and modern engineering has grown up with the background described in the foregoing. For the most part it has been more closely allied with capital than with labor, and there has been little tendency on the part of engineers to organize for protective purposes. Public opinion has been slow to recognize engineering as a "learned profession," but engineering achievement has been so great during the last 50 years that this recognition can no longer be denied. Engineering talent at its highest, the talent that builds great bridges, steamships, railroads, radios and flying machines, can no longer be rated as inferior to that shown by any other professional activity. It does not necessarily follow, however, that engineering as a profession will develop along the same lines as law and medicine.

Society activity and licensing

Group consciousness developed quite early among engineers. The Institution of Civil Engineers of England was started in 1837; the American Society of Civil Engineers was incorporated in 1852. From the latter has sprung by separation the large number of engineering societies that we have today. Without doubt some of these separations were unnecessary and ill-advised, and the standards of admission to many of these American societies are lamentably low. However, the offspring societies may have served a good purpose during rapid industrial expansion.

All of the organizations had for their original purpose the development of the theory and practice of engineering, and for the most part that policy has been maintained down to the present; there has always been a large number of engineers who have contended that engineering societies should devote themselves to scientific discussions and leave broad economic considerations to other organizations. Shortly after the beginning of this century, however, murmurings and complaints began to appear before the governing bodies of the engineering societies to the effect that they should give more attention to the economic status of their constituency. A conservative attitude on the part of these councils resulted in the organization of such new societies as the American Association of Engineers, the Society of Professional Engineers, and others whose primary object is defensive, very much as other industrial workers long before had organized labor unions.

In recent years this movement has grown apace. State licensing of professional engineers is now almost nationwide, and the National Council of State Boards of Engineering Examiners is making a strong effort to have good uniform licensing laws made effective throughout the land. Of far greater importance is the somewhat belated effort on the part of the older and more conservative engineering societies to put their influence behind some sort of a progressive program. This effort is making itself manifest in two ways.

Attempts to coordinate

The first is a movement, sponsored originally by the United Engineering Trustees, having for its purpose the centralizing, on the part of engineering societies, of all efforts that have a common objective. The American Engineering Council is such an effort and has provided means whereby a large number of engineering groups can express themselves on certain matters of

general interest to engineers. The American Standards Association is another similar activity. But there is an immense amount of duplication in the work of the many organizations that is both wasteful and costly. For a year or more a committee representative of the four founder societies has been endeavoring to formulate a plan whereby this wasteful duplication may be eliminated.

A number of schemes for accomplishing this objective have been advanced, but as yet no agreement has been reached, and therefore discussion of any of these plans is premature. It may well be that the "coordination committee" that is now wrestling with this problem may be able to accomplish something with the engineering societies that have headquarters in the engineering building in New York City. What success it may have with the many and varied groups scattered over the country is a question. It will, however, have a cementing influence upon the second and equally important development to be described.

This second movement is a direct outgrowth of agitation among the younger members of the founder societies for fuller recognition of the professional status of the engineer. It has made itself manifest in the creation of the Engineers' Council for Professional Development. Space does not permit an extended discussion of the several steps through which this Council was created, but it may suffice to state that it is sponsored by the A.S.C.E., the A.S.M.E., the A.I.E.E., the A.I.C.E., the A.I.M.M.E., the S.P.E.E., the United Engineering Trustees, the American Engineering Council and the National Council of State Boards of Engineering Examiners. There are, of course, other influential engineering organizations, but this Council presents a movement of the strongest representation that the engineering profession has ever created, and it should make its influence felt. According to the present set up, the Council has a chairman, a secretary and an executive committee; and it is proposed to direct the activities of the Council through four committees, namely: the committee on student selection and guidance; the committee on engineering schools; the committee on professional training; and the committee on professional recognition.

The first committee will aim to provide accurate information and guidance to young men seeking to enter the profession. The second proposes to act as an advisory committee to engineering schools and also to develop criteria for accrediting such schools to the engineering societies, for use in admitting prospective members or for the purpose of licensing. The third committee will try to help the young engineer through the difficult period after graduation when he is striving to make a place for himself in the profession. The fourth committee will try to establish criteria governing recognition by societies and licensing boards, in an endeavor to raise the standard of the profession and of the engineering societies. The preliminary reports of these committees have been accepted by the Council, and the program can be considered as well under way.

The question of regulation

It will be seen that, while much of the work of these committees must be of an advisory character, the work of the second and fourth may go far beyond advice and may enter the field of *regulation*. In fact, to be effective the work of the Council must be more authoritative than simple advice and counsel to growing engineers.

Here then is a program for the profession that envisages the engineer almost from the cradle to the grave. In some respects this is the most important and far-reaching move that the engineering societies have ever made. If the plans that the Council have outlined come to maturity, the general character of engineering practice will be greatly changed. These plans would make engineering more of a closed profession than it has ever been in this country, and it may affect engineering education as well. It may well be that some such limitations are necessary and even inevitable, and it is worthwhile, therefore, to inquire what possibility there may be of bringing these plans to fruition.

First, it should be remembered that there are only two grounds upon which any profession can be closed against all but the elect. The first is the basis of licensing, namely, the protection of the public against dangerous or inferior service on the part of the profession. This is what gives strength to the licensing of doctors, lawyers, plumbers, etc., and is wholly defensible wherever necessity warrants its promulgation. The second reason for exclusiveness is that which underlies labor unionism, namely, self-interest on the part of the group and a desire for just remuneration and fair practices. In the light of certain portions of the National Recovery Act this would appear to be defensible, though it represents a departure from the spirit of the engineering societies as they now exist.

Correcting professional evils

It is commonly assumed, especially by proponents of registration and licensing, that licensing alone will cure many of the evils of engineering practice now complained of. Experience would indicate that this is not true. Licensing as now practiced will insure a minimum degree of training and experience, but it will not insure moral character, nor will it provide work for all licensees. Wherever competition is sharp, unfair and evil practices are sure to appear.

Consider the legal fraternity, which has long had licensing as a requisite for practice and which is notorious for its competitive evils—despite the effort of a large body of able and high-minded men in the profession. Or, consider the medical profession, which is in a similar predicament, though possessing the highest claim to exclusiveness on the ground of protecting the public against charlatanism; but quackery of many kinds still exists. It is forbidden by law to prescribe for bodily ailments unless licensed, yet proprietary medicines claiming to cure all the ailments flesh is heir to are sold in immense quantities without let or hindrance.

If this be the state of affairs in professions that have a strong claim to exclusiveness, it may be pertinent to ask what can be done with engineering, which has a much weaker claim to exclusiveness and whose field of action is much less clearly defined than law or medicine. Men in these latter professions render definite services, but engineering is the very essence of all industry and permeates every nook and corner of our modern life.

Public safety considerations

There are certain engineering activities that should obviously be licensed, namely, those by which safety of life and limb may be endangered, as bridge design, or by which public health may be jeopardized, as sanitary engineering. But a very large part of what is now characterized as engineering has little or no relation to public safety, and the only reason for licensing practitioners in this field would be guild exclusiveness.

It would appear that any approach to successful exclusiveness in the engineering profession must be preceded by careful classification. Some of the resulting divisions may be adequately protected by licensing, but the remaining groups could protect themselves against unfair practices only by labor-union methods. The history of labor unionism in this country, however, would indicate that this is a rather weak reed upon which to lean. If the regulatory methods now being advanced by the NRA should become a permanent part of governmental operation, they might provide adequate protection for all such groups, and that may be the final solution of our crowded civilization, exactly as in the days of Hammurabi.

Whether such rigid federal regulation will be extended to the professions remains a question. The objection of some professional men against having their professions codified under the NRA, lest they lose their professional status by such regimentation, seems reasonable. But it would have less weight in the case of other groups, of lower professional status; and if we are to abandon open competition, some such provision must be made for a very large number of men who are classed generally as engineers but are ineligible to

the ranks of licensed professional men. Indeed, the application of NRA principles to engineering might help to answer the troublesome questions of "What is engineering?" and "Who should be called an engineer?"

The writer is not advocating such procedure, but is advancing these statements only in the hope that they may bring forth helpful discussion. One thing is sure, the wind sets in the direction of some form of regulation of all industries and all professions. This has always been the case in all crowded civilizations. Engineering can be no exception to the general rule, and it offers the most difficult problem because of its natural and inherent influence in all industry.

Effect on societies and education

Any such general classification and regulation of engineers must necessarily affect the engineering societies. For, if engineering in its strictest sense is to be an exclusive profession, the national bodies from which leadership is expected must necessarily be of much more exclusive character than many of them are at present. This does not mean that these societies cannot be widely inclusive as at present, but it does mean that the governing group, the nucleus, so to speak, of any such society must necessarily consist of those who can actually qualify as engineers. In some of the societies this would automatically eliminate many men from full membership and probably would result in a reduction in numbers.

Furthermore, if licensing of engineers should attain the status of that now seen in law and medicine, the instruction in all engineering colleges might be greatly affected in some particulars. Legal instruction, no matter how broadly the foundations may be laid, must be directed eventually toward the state bar examinations, which are the gateway to professional practice. It will be noted that almost the first act of the National Council of State Boards of Engineering Examiners was an effort to define the scope of engineering education. The difficulty of such a proceeding is clearly evident in the amateurish first draft which resulted.

Engineering, I would repeat, differs greatly from law and medicine in that the field is much more diverse and much less clearly defined. There is no "pattern" on which all engineers may be molded. Law and medicine enter into our lives only as incidental matters, but engineering is all-pervasive and touches all activities of our lives. We are all engineers to some extent. For this reason engineering education has become a preparation for industrial life in a broad way, 75 per cent of all technical graduates eventually occupying administrative positions. Any attempt to narrow engineering education to fit the licensing laws of any state would be catastrophic and should be resisted strenuously.

This does not mean that colleges should not prepare such students as may wish to take out state licenses for these examinations. As a matter of fact, the curricula of all good engineering colleges in this country even now offer good preparation for such examinations so far as basic technical instruction is concerned; for such examinations, to be fair, must also be general and within the reach of every first-class curriculum.

It will be evident, I believe, that the issues raised in the foregoing are of prime importance to the engineering fraternity, particularly in view of probable codification to some extent by the NRA. No matter what features of the new deal may or may not become a permanent part of our industrial economy, it is clear that we have arrived at such a density of population and a complexity of industrial relations that *laissez-faire* is no longer a working basis. Yet we should give careful thought to the implications of any such program of regulation and licensing as is proposed.

Legal regulations, like inflation, are sometimes difficult to limit and control and may go far beyond anything contemplated in the beginning. The Code of Hammurabi not only fixes the remuneration of the doctor but provides further that, should the patient die from a surgical operation, "The surgeon's fingers shall be cut off." Medieval law provided that if a doctor contracted to cure an ailment and failed to do so he paid back any fees that he may have received for the treatment. We have never gone this far in modern licensing procedure, but history has a curious way of repeating itself, and it may well be that in the future, if exclusive rights are given to any professional group, corresponding obligations of performance may be enacted to a degree not now contemplated by proponents of classification and licensing.

While, therefore, this program of the Council for Professional Development is a timely move and no doubt looks in the right direction, it should be appreciated that neither the objectives to be attained nor the methods of attaining them are clear at present. To raise the profession to the level we all wish and believe in is much more of a task than simple licensing and regulation of college degrees that may lead thereto. It means a *classification* much more searching than exists or can exist in any other profession. Nevertheless all engineers should support this, the first attempt to bring order out of chaos in a profession that is basically of the utmost importance to humanity.

Recent Developments in Engineering Registration

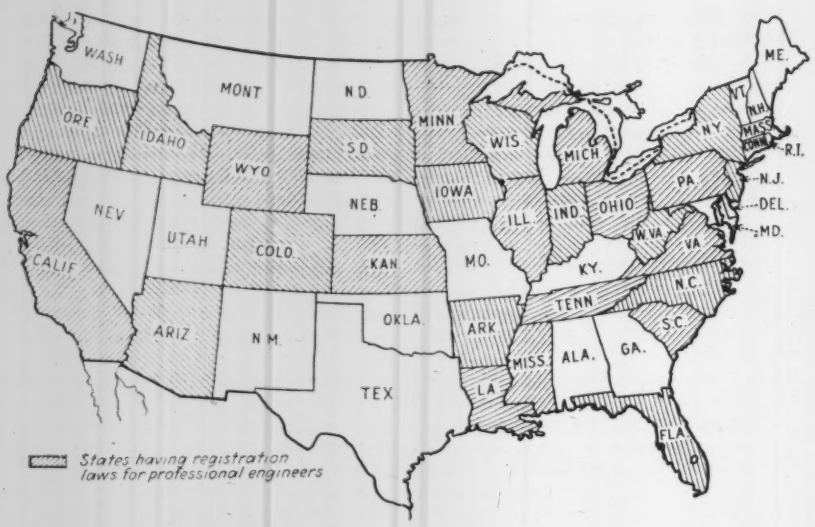
Twenty-seven states now have some form of registration law for engineers—Uniformity promoted by the National Council of Engineering Examiners

By T. Keith Legaré
Executive Secretary, National Council of State Boards of Engineering Examiners, Columbia, S. C.

RECENT developments bearing on the subject of the registration of engineers are indicative of the growing acceptance of the principle underlying our state registration laws. Most significant of these developments is the decision to include in the NRA codes a code for engineers functional to the construction industry and the acceptance by that code of registration as evidence that a man is qualified to be classed as a professional engineer in all states where registration laws are on the statute books. Twenty-seven states now have such laws, and in sixteen others some effort is being made to have registration laws passed.

Engineering has developed its legal status differently from most other professions. The medical profession, for example, adopted regulations controlling medical practice as early as 1639 in Virginia, but did not organize its national society, the American Medical Association, until 1847. Therefore, it will be noted that the medical profession had its legal qualifications well established long before its professional society was organized, and the society was probably developed as a result of activities connected with the enforcement of registration or license. The engineering profession organized its first national society, the American Society of Civil Engineers, in 1852, and adopted its first registration law (that of Wyoming) in 1907. The engineering societies not only were organized before engineering registration was promoted but assumed the attitude that registration was not necessary because the societies were "all-sufficient" and that the practice of the profession should be based entirely on ethical procedure and not be controlled by legal regulations.

Now that registration has the nearly unanimous support of the national engineering societies, it is believed that there



The states shaded on the map now have registration laws for professional engineers. The law of Illinois pertains to structural engineers only. Hawaii, the Philippines and Porto Rico also have registration laws for engineers; New Mexico and Texas have laws governing land surveyors. Registration acts have been introduced in the state legislatures or are now being promoted in the following states: Connecticut, District of Columbia, Missouri, Illinois, Utah, Maine, Oklahoma, Nebraska, New Mexico, Delaware, New Hampshire, Alabama, Maryland, Washington, Georgia and Texas.

will be steady progress in the adoption of new registration laws and the improvement of existing laws.

Reference to the registration of engineers in a national document like the engineers' code raises question as to whether it may lead to some form of national registration of engineers. There can be no "national registration" for engineers in a legal sense, as no national board or organization can grant permission to anyone to practice the profession of engineering in any of the states. That power rests only in the states themselves, and only the individual state boards, created by legislative enactment, can issue certificates that *legally authorize* engineering practice. However, this sovereign right of the states is in no way encroached upon by the establishment of a system of *national qualification* for engineering registration, which will simplify the process of obtaining state registration by qualified men, will facilitate reciprocal relations between state boards and foster development of uniformity in state requirements for registration as an engineer. This was the objective in mind when the National Bureau of Engineering Registration was proposed. Its purpose was not to supplant state registration.

The National Council of State Boards of Engineering Examiners, at its recent annual meeting, definitely provided for the continuation of the National Bureau of Engineering Registration as a function of the National Council by including in its revised constitution and by-laws a provision for the administration of the registration bureau, which in part reads as follows:

"The registration bureau shall investigate and verify the professional records of engineers and issue certificates of qualification to engineers who comply with its requirements. These certificates shall be available *as evidence of qualification* for registration as a professional engineer with state boards of registration, for membership in national and state engineering societies, in connection with the award of professional degrees by engineering schools, for presentation to clients when soliciting contracts for professional services, for presentation to employers when applying for positions, and for similar purposes.

"Whenever legally possible and in the absence of disqualifying evidence, member boards are expected to give due consideration to, recognize, or accept as *competent evidence of qualification*, the certificates of qualification when submitted in support of applications for registration, or as reciprocal endorsement when submitted by applicants who are registered with some other member board, or as the equivalent of reciprocal registration certificates or cards issued by member boards, or as *prime facie* evidence of qualifications in lieu of examinations."

Certificates issued by the bureau have recently been utilized by a number of engineers in connection with applications filed for positions with the federal government and for various civil service examinations. Without doubt these certificates may also be used in the future for identification under the NRA code for professional engineers. The bureau also makes investigations for state boards of registration of the professional records submitted by engineers. Some of the activities originally suggested for the registration bureau are now being developed by the Engineers' Council for Professional Development; and, as the National Council of State Boards of Engineering Examiners is a member of that body, the coordination of the work of these two organizations is assured.

The national engineering societies have recently demonstrated a commendable spirit of cooperation with the National Council and an interest in the work of the registration bureau by appointing on its advisory board some of their most distinguished members. These societies and their official representatives are:

GENERAL REQUIREMENTS FOR REGISTRATION OF ENGINEERS

State	Age, Years	Active Practice Without Graduation, Years	Responsible Charge of Work, Years	Allowance for Engineering Graduation, Years	Active Practice With Graduation, Years	Oral and/or Written Examination
Arizona	25	6	0	4	2	Conditional
Arkansas	21	4	..	2	2	Required
California (Civil)	25	6	1	4	2	Required
Colorado	25	7	0	4	3	Conditional
Florida	21	3	1	3	0	Required
Idaho	21	6	0	6	0	Required
Illinois (Structural)	21	6	2	2	4	Required
Indiana	25	10	0	6	4	Conditional
Iowa	25	6	1	..	..	Required
Kansas	25	4	..	..	..	Conditional
Louisiana (Civil)	21	(Written Examination or College Degree)				Optional
Michigan	21	6	0	4	2	Required
Minnesota	25	6	0	..	..	Conditional
Mississippi	21	6	1	5	1	Optional
New Jersey	21	6	1	2	4	Conditional
New York	25	8	0	4	..	Conditional
North Carolina	21	5	..	5	0	Conditional
Ohio	..	8	..	4	4	Required
Oregon	21	6	1	4	2	Required
Pennsylvania	21	10	..	8	2	Conditional
South Carolina	21	4	1	4	0	Required
South Dakota	21	6	..	4	2	Required
Tennessee	..	4	0	4	0	Conditional
Virginia	21	4	0	4	0	Required
West Virginia	..	7	..	4	3	Conditional
Wisconsin (Civil)	..	7	..	4	3	Conditional
Wyoming	25	8	0	4	4	Required
Registration Bureau	..	8	..	4	4	Required
Model Law	..	8	..	4	4	Required
NRA Engineers' Code	..	8	1	4	4	.....

The above tabulation is based on an analysis of state registration laws prepared by the Western Society of Engineers.

Only the principal requirements for registration are given here. Under certain conditions neither graduation from an engineering school nor examination is required; some such cases being "grandfather" provisions, reciprocity between states, and engineers of recognized standing with extensive experience.

American Society of Civil Engineers, George T. Seabury; American Society of Mechanical Engineers, John H. Lawrence; American Institute of Electrical Engineers, Walter I. Slichter; American Institute of Chemical Engineers, J. C. Olsen; Society for the Promotion of Engineering Education, R. I. Rees; American Railway Engineering Association, R. E. Warden; and American Association of Engineers, C. J. Ullrich.

In the early days of engineering registration there was wide divergence between the requirements of state registration laws and a great lack of uniformity in stipulated qualifications and in definition of function. But much of that divergence has been eliminated through study and exchange of views through the medium of the national engineering societies and the National Council of State Boards of Engineering Examiners. The model registration law, developed through the cooperation of these organizations, has been an important factor in this progress toward better and more uniform laws. As an indication of its value, the Ohio law, recently adopted, is practically identical with the model law.

The accompanying table, based on a more elaborate one prepared by the Western Society of Engineers, is indicative of the trend toward uniformity. Complete uniformity may never be attained because of the wide variation in the work of engineers in the several states, but those who have followed the movement closely hope to see many more of the differences eliminated and gradual progress toward higher standards throughout the nation.

Elimination of Odors in Sewage-Treatment Works

GREAT PAINS are taken to reduce objectionable odors to a minimum in the operation of the sewage-treatment plant at Dayton, Ohio, and the result has been a marked improvement in public good will. The plant is visited freely, and the adjacent golf course, tennis courts and picnic grounds are well patronized. The aversion of the public has been lessened because the plant grounds do not look as though they would have a bad odor. Nevertheless the operators recognize the fact that sewage still smells like sewage, no matter how sweet the surroundings.

The source of all sewage-plant odors is the sewage itself. This "natural odor" has the combined smell of dishwater, soap suds, gasoline, body wastes, etc., all mixed up and often flavored with the characteristic odor of some industry. Although this odor is usually not very intense, it is the first one encountered about the sewage plant; and as it is unfamiliar to the lay visitor, it is liable to smell "very bad indeed." At Dayton the psychological cure is attempted, by planting large flower beds near the plant entrance and landscaping the whole so as to give it the general appearance of a park instead of a sewage-treatment plant.

The many other odors about any plant are caused either by various gases of biological origin or by some industrial waste peculiar to the locality. The most serious one of the entire group is hydrogen sulphide. This gas is very volatile, foul-smelling and far-reaching. It can be dissipated and carried for great distances by light winds and is disagreeable when present in even small quantities. The nuisance is greatest at night, when, becoming cooled, the gas lies close to the ground and is rolled along for considerable distance. Chlorine kills the hydrogen sulphide organisms present in the sewage and retards their subsequent development, and also destroys any hydrogen sulphide that has been produced ahead of the point of chlorination.

Any material removed from the sewage in the various steps of treatment is subject to bacterial action and the attendant odors of putrefaction. This includes grease skimmings, grit and screenings. At Dayton, all grit is removed to a dump each day and, unless it is disturbed there, the amount of organic matter it contains creates no odor nuisance. All grease skimmings and screenings are burned each day. This work is done on the night shift to eliminate as far as possible any unsightliness and fly nuisance about the plant, and, too, the helpers can see to clean up better in daylight than by artificial light. All containers for grease skimmings as well as the screen pits, the screenings elevators, hopper and press are cleaned with hose and water each day. This procedure eliminates every source of odor. The incinerator firebox temperature is maintained by automatically controlled valves at 1,800 deg. F., which insures no odor nuisance from that source.

Oil and grease skimmings in any sewage channel or tank become a source of odor nuisance if allowed to accumulate as grease rings on the walls. They melt in the sun, turn rancid and give off a nauseating odor. This source of odor is eliminated by keeping such grease lines scraped off.

The gases incident to sludge digestion have varying degrees of odor that are always objectionable. This source of odors was eliminated by the choice of Imhoff tanks equipped with a gas-collection sytem, which becomes an economic asset as well as an elimination of a source of odors. The effluent weirs of an Imhoff tank may become a source of objectionable odors if the sewage is "stale." The dissolved gases are released by the mechanical agitation of the water as it falls over the weir into the effluent channels. The application of chlorine in sufficient quantities inhibits the production of this gas and stops the nuisance at its source.

Any well-digested sludge produces very little odor. Dayton Imhoff sludge is drawn onto sand beds, which are covered with glass to minimize odors from this source. The glass cover works most effectively; the only odor that is noticeable is a "musty odor," found particularly on extremely hot days when the humidity is high. This odor is entirely local.

The whole plan of odor control at Dayton has been built around the idea that an odor anticipated and prevented is far preferable to an odor dissipated and complained of, and also on a recognition of the fact that the general public does not think of the small amount of emanation in the nostrils but of the material source from which it has come.

Abstract of a paper presented Oct. 13 at the Indianapolis meeting of the Central States Sewage Association, by M. W. Tatlock, superintendent, sewage-treatment plant, Dayton, Ohio.

Elimination of Slums by 1938 Proposed for England and Wales

A fundamental change in the housing policy of England and Wales is effected through a law recently enacted. Exchequer subsidies heretofore granted to aid in the construction of working-class houses are terminated. The national government now proposes to concentrate on slum clearance, and, with this end in view, will restrict the sanction of new subsidies to dwellings built to house persons moved from slum areas.

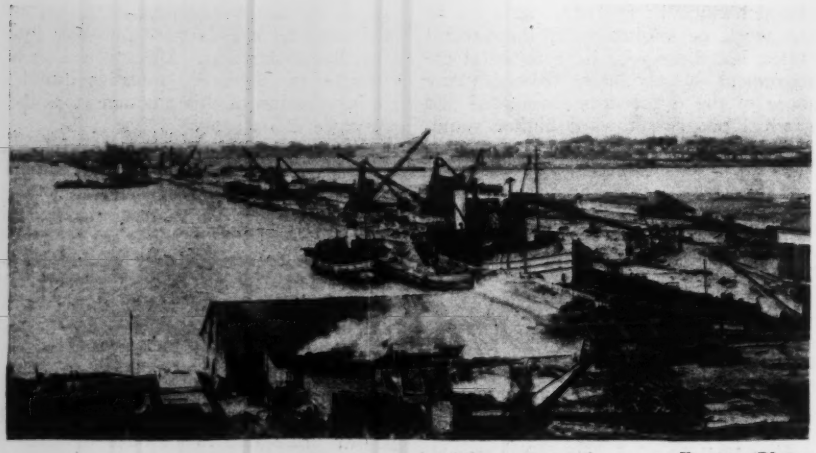
An Exchequer subsidy of £2 5s. for every person displaced will be granted and, in addition, the local authorities will grant £3 15s. for each slum dwelling cleared. The elimination of all slum areas in England and Wales by the end of 1938 is proposed.

During the thirteen-year period ending March 31, 1932, the national Exchequer granted a total of £109,951,400 in housing subsidies. In that period 1,866,040 houses were built, 1,068,800 with government assistance.

Housing subsidies in the fiscal year 1932 totaled £12,731,600. Thus, the new law practically stabilizes Exchequer commitments to housing, exclusive of slum-clearance subsidies, at approximately £13,000,000 annually.

Southampton's Great Quay and Dry Dock

Important English harbor enlarged by new dredged channels, 400 acres of reclaimed tidal flats, 1½ miles of concrete quay wall and a 1,200-ft. dry dock



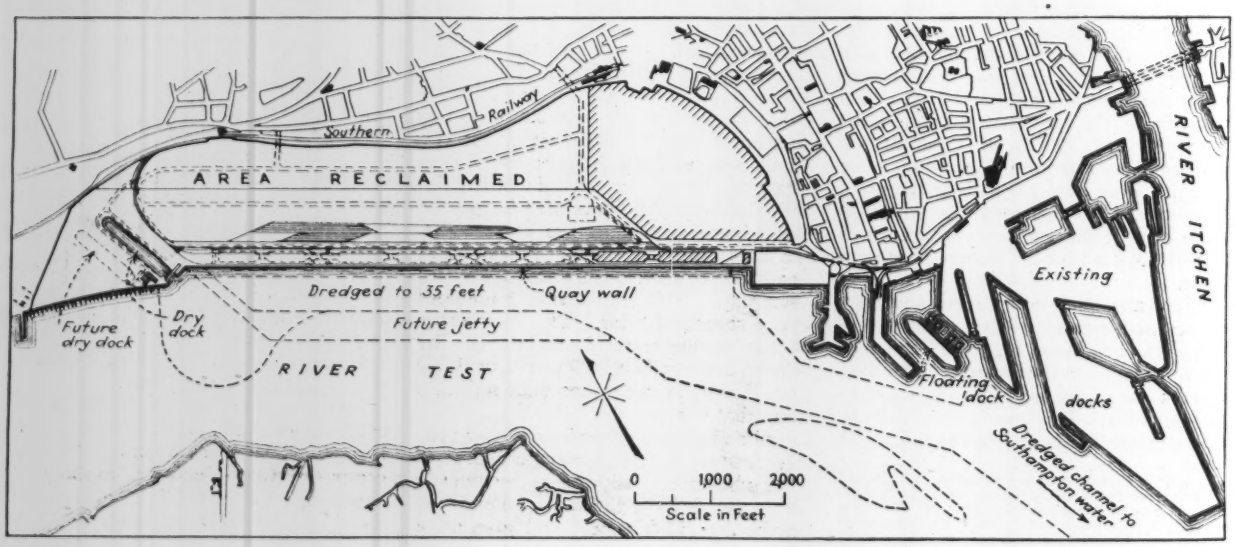
Keystone Photos

Fig. 1—Work in progress on Southampton 1½-mile quay wall formed of 146 concrete caissons sunk from 70 to 110 ft.

EXTRAORDINARY caisson sinking for a quay wall and deep well-point drainage for a dry dock placement pit are outstanding among construction operations at the new harbor works at Southampton, England. In passing, it is to be noted that the Southampton dockworks are among the largest of recent harbor improvements; the dry dock is the longest in the world, the widest except that at St. Nazaire and the deepest except that at Havre. The general plan of all the new works is indicated by the descriptive map below, redrawn from *The Engineer* of London. Only the quay-wall caisson work and the well-point drainage of the dry dock excavation are subjects of the present account.

The quay wall extends 1½ miles along the front of the reclaimed area, Fig. 2. Along its line the original tidal flats were dredged through 12 ft. of mud to gravel. In this dredge cut a dike of gravel was deposited, rising to above highest tide level and with a least width of 167 ft. on top. This embankment served both to retain the hydraulic fill of the reclaimed area and as a gravel island through which to sink the quay-wall caissons. The latter objective was the reason for the great width adopted.

Fig. 2—Existing docks at Southampton, England, being extended by 1½-mile quay wall and 1,200-ft. dry dock, showing the dredged channels and the future dry dock and jetty.



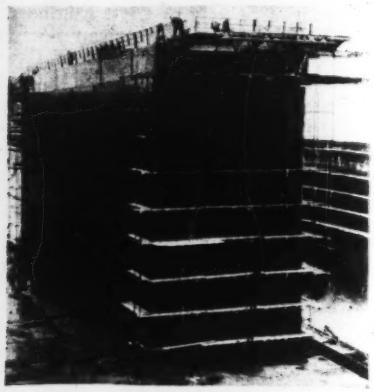


Fig. 3—Sliding caisson gate 141¾ ft. long and 58½ ft. high for closing entrance to 1,200-ft. dry dock at Southampton.

A total of 146 caissons was sunk to depths of 71 to 110 ft. to form the wall. The caissons were 45 ft. square and were sunk with a space between them of 4 ft. for part of the wall and of 7 ft. for the remainder, as the 4-ft. spacing at times somewhat cramped the sinking operations. Along part of the wall the spaces between caissons were closed by steel sheetpile diaphragms, and along another part they were left open. Concrete slabs spanned the spaces and a coping wall of concrete extended the whole length of the quay. Above the caissons the height to quay level was filled with gravel, which carried double railway tracks, and a quay paving of concrete or tar-macadam.

In the accompanying views, Fig. 1 shows the line of the quay-wall work and Fig. 4 is a close view of caisson-sinking operations. As indicated the caissons were of concrete with nine octagonal wells, about 10 ft. in diameter, placed in rows of three. The concrete shafts were built up on steel shoes 5 ft. high and having nine openings corresponding to the wells in the shaft. Each shoe weighed about 35½ tons. The concrete in the shoe and for 10 ft. above was heavily reinforced. Above this the shafts were in some caissons of monolithic concrete, and in others of 5- to 10-ton precast concrete blocks, the choice being determined by reasons affecting the progress of construction. A 1:6 concrete was employed. The caissons ranged in weight from 5,000 to 7,000 tons. In sinking some of the caissons, however, they had to be loaded with from 3,000 to 4,500 tons of 4½-ton cast-iron blocks.

As indicated by Fig. 4, the caissons were sunk by excavation through the wells with 15-ton traveling cranes with 1½-yd. clamshells. When hard strata were encountered which the clamshell could not easily dig, use was made of an unusual chiseling device. This consisted of a number of steel I-beams set vertically and framed together in the form of a cage fitting the shape of the caisson wells. This cage, handled by a crane, was lifted and dropped in the wells where the hard material was encountered until the sharpened ends of the I-beams had broken up the obstruction. Use was also made of a device operated like the cluster of chisels to loosen the sand by surging the water in the caisson. It consisted of a horizontal plate fitting the caisson well loosely and attached to a circle or cage of I-beams by which it could be churned rapidly up and down like a piston in the water in the well. With a hole in the center of the plate the churning of the water was violent enough to keep the cutting edge washed clean and in the best condition for penetrating the ground.

No exceptional difficulties were experienced in sinking the caissons. This general success is attributed partly to the construction of the caisson with nine wells. By excavating the center well deeper than the others, resistance was reduced under the cross-walls, and the sinking was made easier.

Dry dock construction

The dry dock, 1,200 ft. long, 135 ft. wide and 48½ ft. deep, was begun in June, 1931, and completed in April, 1932. The construction involved 1,258,000 cu.yd. of excavation and 456,000 cu. yd. of concrete. The tidal mud land of the site was inclosed by a gravel dike with a steel sheetpile core. After the site was pumped dry a trench 43 ft. wide and 53 ft. deep was dug for each wall, and after the walls were concreted the earth core was removed and the floor was concreted. The foundations were clay.

Soon after the excavation at the site had begun, bore holes gave indications that beneath the intended foundations of the dock artesian water at considerable pressure was present. It was found that a bed of sand charged with water lay beneath the bed of clay in which the foundations of the dock walls and floor were to be constructed. The clay that would remain between the foundations and the sand bed was of varying thickness, but in some parts it would be so thin that blows would almost certainly occur in the excavations unless means were taken to reduce considerably the pressure of the subterranean water.

It was decided to sink five tube wells on each side of the dock site. These wells were carried down into the sand bed. The tubes were 24 in. in diameter. Inside the 24-in. tube a second or suction tube, 14 in. in diameter, was in-

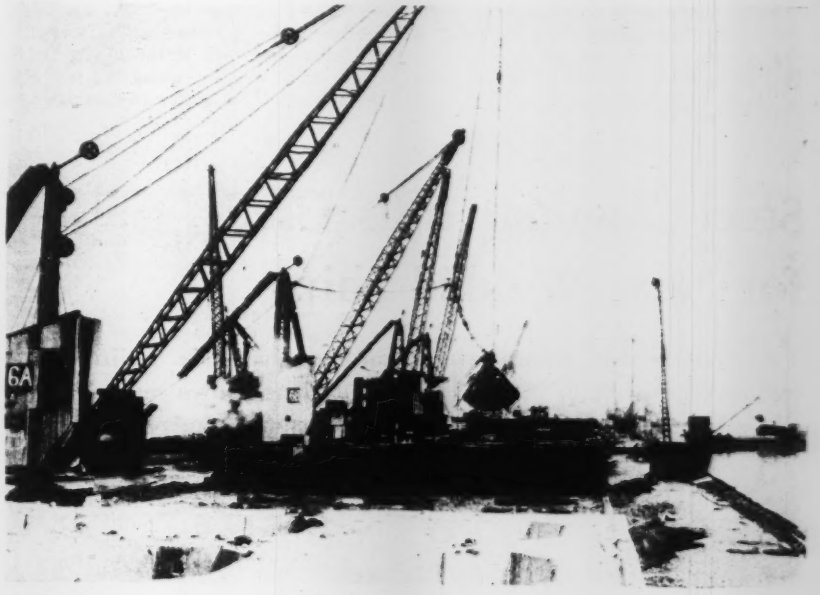


Fig 4 (above)—Sinking concrete cellular caissons, 45 ft. square and 70 to 110 ft. deep, for Southampton quay wall.

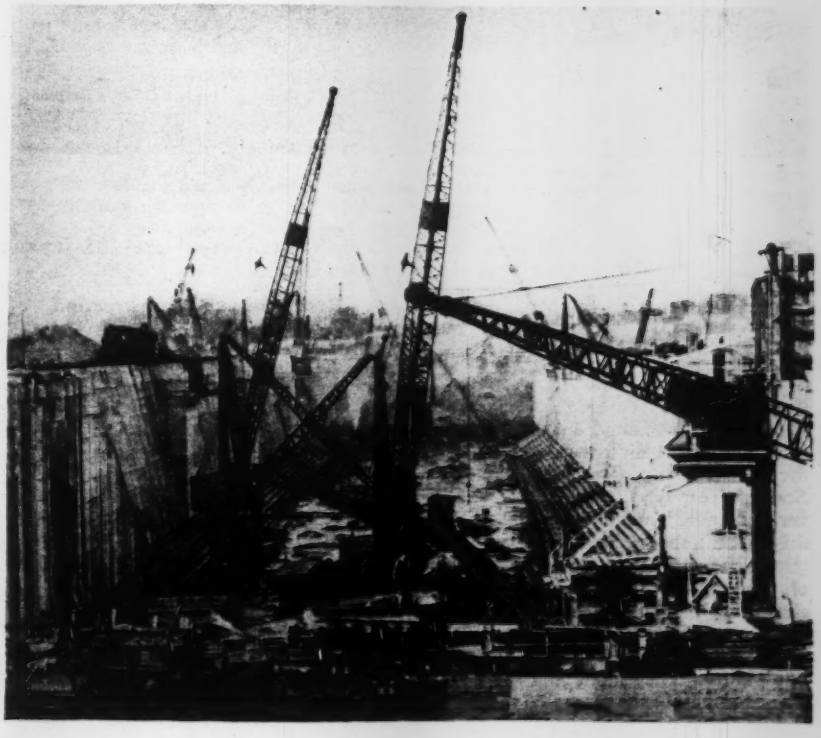


Fig. 5 (below)—Massive concrete walls and floor of 1,200-ft. dry dock under construction for Southampton dock extension works.

serted. The lower end of the suction tube was perforated and wrapped around with filters of fine copper wire gauze. The space between the perforated tube and the 24-in. pipe was then filled with pea gravel up to the surface of the sand bed. Above this the annular space was filled with clay and the 24-in. boring tube was then withdrawn. An electric submersible pump was then lowered into each of the 14-in. suction wells.

These pumps were worked continuously throughout the construction of the dock and lowered the pressure head of the artesian water to such an extent that all upward pressure on the stratum of clay which forms the foundations of the dock was relieved during the construction of the works.

The application of tube-well pumping of artesian water was on a larger scale than anything that had ever before been attempted. The head of water was lowered by pumping as much as 90 ft., i.e., from + 110 ft., at which level the water rose in the tube, to + 20 ft.

On the completion of the walls and floor the pumps were withdrawn one by one, but the wells were not filled in and are now connected by horizontal drains to the dry dock so as to permit the discharge of water rising in the wells at a level of about 40 ft. below the coping. The water so discharged is led to the drainage sump and is dea with by the dock drainage pumps. Th use of the wells as a permanent pr vision has the effect of lowering th level of the standing water behind th dock walls and reducing the upwa pressure under the foundations at tim when the dock is empty.

The dry dock under construction shown by Fig. 5, and Fig. 3 shows th sliding caisson that closes the entranc to the dock. This caisson is 141¾ ft. long on the dock side and 137¾ ft. lon on the river side, 58½ ft. high an 29½ ft. wide over timber fenders.

The new Southampton dock extensio works are being built by the Souther Railway Company of England.

Steel-Channel Hulls Used for New Welded Ships

Two vessels for transporting building materials utilize steel-channel sections in two different designs known respectively as reverse-channel and transverse-channel construction

Fig. 1—A 1,000-ton ship for transporting hollow tile, which uses a special welded hull of steel channels placed alternately in and out.

TWO self-propelled all-steel cargo ships, one built in New York City, for coastwise transportation of hollow tile, and the other built in Rochester, N. Y., for use in handling crushed stone on the Great Lakes and through the New York Barge Canal to New York and Washington, afford important recent examples of welded construction. The first vessel, owned by the New Jersey Clay Products Co., South River, N. J., uses a patented reverse-channel system in its hull. With this system the channels are turned alternately in and out and run lengthwise of the ship. In the other vessel the channels are all turned in and run transversely—that is, up and down the sides of the hull and across the bottom. This latter ship is 212 ft. long and has a gross tonnage of 1,700; comparable figures for the hollow-tile vessel are 185 ft. and 1,000 tons.

Reverse-channel construction

It is the claim of the builders and the designers of the "William F. Kenny," the name of the New Jersey Clay Products Co.'s vessel, that the reverse-channel method of hull construction provides maximum rigidity, reduces costs through elimination of riveting, increases usable space in the hold, decreases hull weight and increases the speed of fabrication. Although this type of hull construction might have some effect upon the speed of the ship, the designers maintain that in a ten-knot ship this effect would be quite immaterial.

The steel channels, 12 in. by 20.7 lb., were delivered to the shipyard in 60-ft. lengths. In assembling the hull the frames were built alongside the keel blocks and a tier of seven channels was placed, locked in position and welded, flanges being allowed to overlap 1⅛ in. The completed unit was then hoisted into place in the keel blocks and welded to similar adjoining units. The entire hull, including underbody, stern and bow sections, was constructed by the same method.

The ship is not only self-propelled but is also equipped to load, handle and unload its cargo, which will consist mainly of 610 collapsible metal crates, each holding 2 tons of hollow tile. The handling equipment consists of a mobile, electrically operated whirler crane mounted on a carriage on the deck. The handling crates consist of skeleton steel frames with two-hinged sides, permitting the crates to be stored when not in use, thus making possible the transportation of considerable return cargo. The owners expect important economies to result from the use of these crates because of the reduced breakage of tile.

Tile previously has been transported to Washington from the owner's plant in towed barges. The six to eight days previously consumed in transport will now be reduced to two days. Also, unloading of the barges previously required 1,368 man-hours, while the "William F. Kenny" can be unloaded in only 142½ man-hours. The ship was designed by Henry J. Gielow, Inc., and was built by the United Drydocks, Inc., at its Staten Island plant.

Transverse-channel construction

The "Dolomite," which is the ship recently completed at Rochester, is also of the self-unloading type; the belt conveyors will handle 300 to 400 tons of crushed stone per hour, while pumps are installed that can unload 1,600 gal. of liquid per minute from the ship's tanks. The hull of the ship, instead of being constructed in the usual frame and shell design, is built of steel channels 12 in. by 20.7 lb. These channels are bent and shaped cold by a process patented by the ship manufacturer. After being bent to shape, the channels are placed in po-

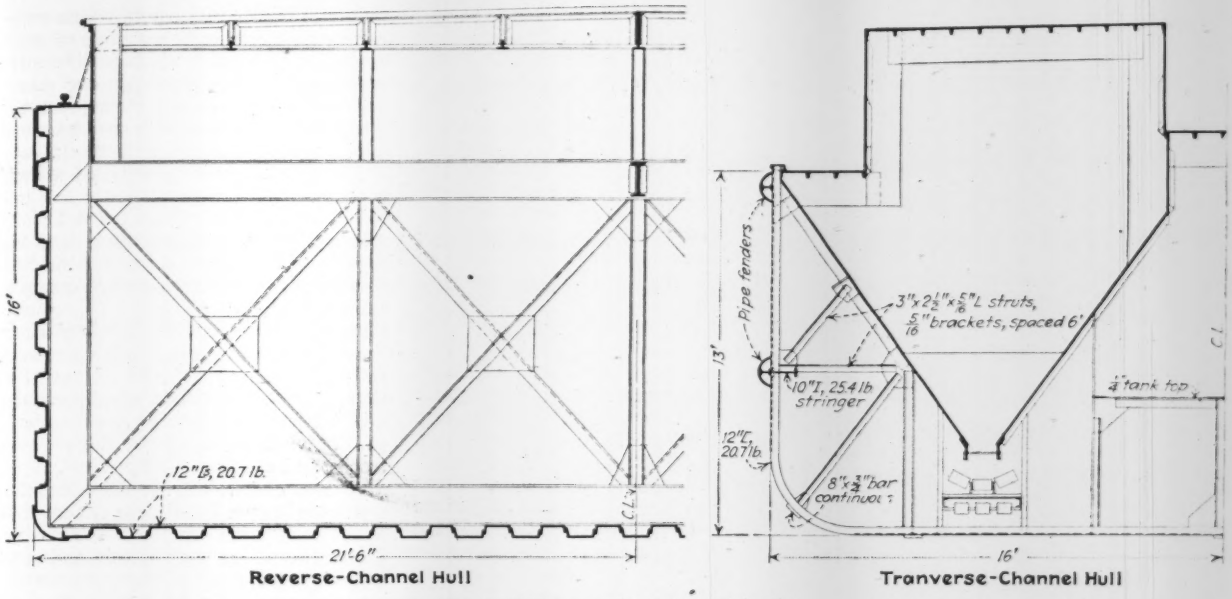


Fig. 2—Half cross-sections of two channel-hull ships of different designs.

sition and welded continuously, heel and toe, to adjoining channels. The designers estimate a saving of about 30 per cent in the total dead weight of the ship over a comparable riveted design. The bow and deck are also constructed of 12-in. channels. The stern is plated.

The ship is of the semi-submersible type, permitting increase in draft when entering the Barge Canal and thus facilitating its passage under low bridges.

The ship was designed and built by the Dolomite Marine Corp., John H. Odenbach, general manager; John Cattanach, chief engineer, and C. Wesley Werth, assistant engineer. It will be used by a subsidiary company, the Dolomite Products Corp.

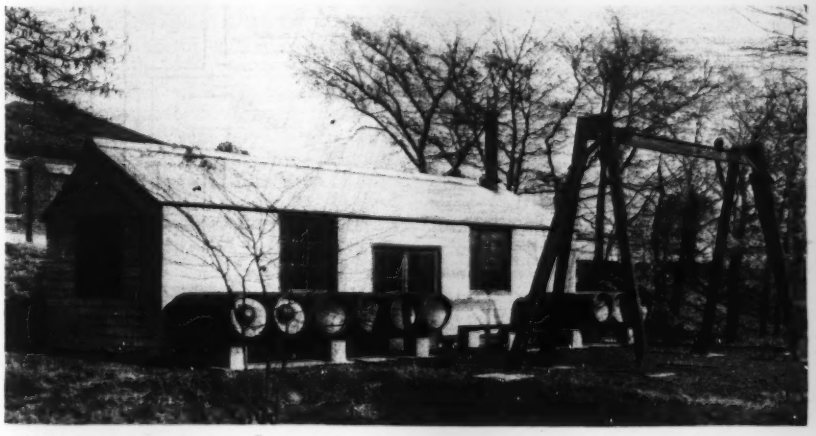
Economical Construction for Prechlorination House

ASBESTOS-BOARD walls and roof, a concrete floor and a welded steel frame have been combined by the engineers of the Indianapolis Water Co. to make a durable and low-cost building to house its prechlorination equipment. The design was based primarily on the desire to keep the investment in the building low, since the company has plans for a complete new pretreatment plant some time in the future. Fire resistance and low maintenance cost were corollary design considerations.

The building is 35x17 ft. in plan and 9 ft. high to the eaves of its gable roof. Its primary purpose is to house 1-ton drums of chlorine and the necessary equipment for weighing and moving these drums into position for attachment to the raw-water inlet from an adjacent canal. A coke-fired furnace, attached to unit heaters, occupies one end of the structure.

The most unusual feature of the building is its inclosure. The outside walls consist of ¼-in. asbestos clapboard lumber, backed up with ⅜-in. wood sheathing and a layer of roofing felt. The inside walls and ceiling are of ¼-in. flat asbestos board. Between the exterior and interior walls is a 3-in. air space. Finally, the roof is covered with ¼-in. corrugated asbestos board. None of the exterior or the interior is painted. Roof boards are fastened to the frame by aluminum ties. Copper nails are used on both inside and outside walls.

The steel frame of the building is simple, consisting of 6-in. I-section columns, angle-iron girts, roof trusses and I-section purlines. All shopwork was welded, and the entire framework was assembled in the shop before delivery. Steel doors and steel sash windows are used throughout, flashed with sheet copper. Steelwork was by Hugh J. Baker & Co., and inclosure by the Philip Carey Co. Foundation work was by Ray T. Fatout, Inc. W. C. Mabee is chief engineer of the Indianapolis Water Co.



Asbestos-board walls and roof inclosing a welded steel frame provide a durable prechlorination house for the Indianapolis Water Co. Ton chlorine drums are shown on racks. The brick building in the background is the meter house on the bank of the canal.

Street-Car Viaduct Built Over Railway Terminal

Access to Century of Progress Exposition in Chicago is effected by a steel viaduct built in record time through and over the Illinois Central Railroad terminal

By Samuel Moreell, Jr.
Chief Engineer, Kettler-Elliott Co. Chicago, Ill.

DIRECT ACCESS to the Century of Progress Exposition at the Chicago lakefront for the great mass of visitors has been facilitated by extending two street railway routes, one at 22d St. and the second at Roosevelt Road (12th St.). Both extensions were built in record time at an aggregate cost of $250,000. The Roosevelt Road line, completed in 30 days, presented the greater physical obstacles.

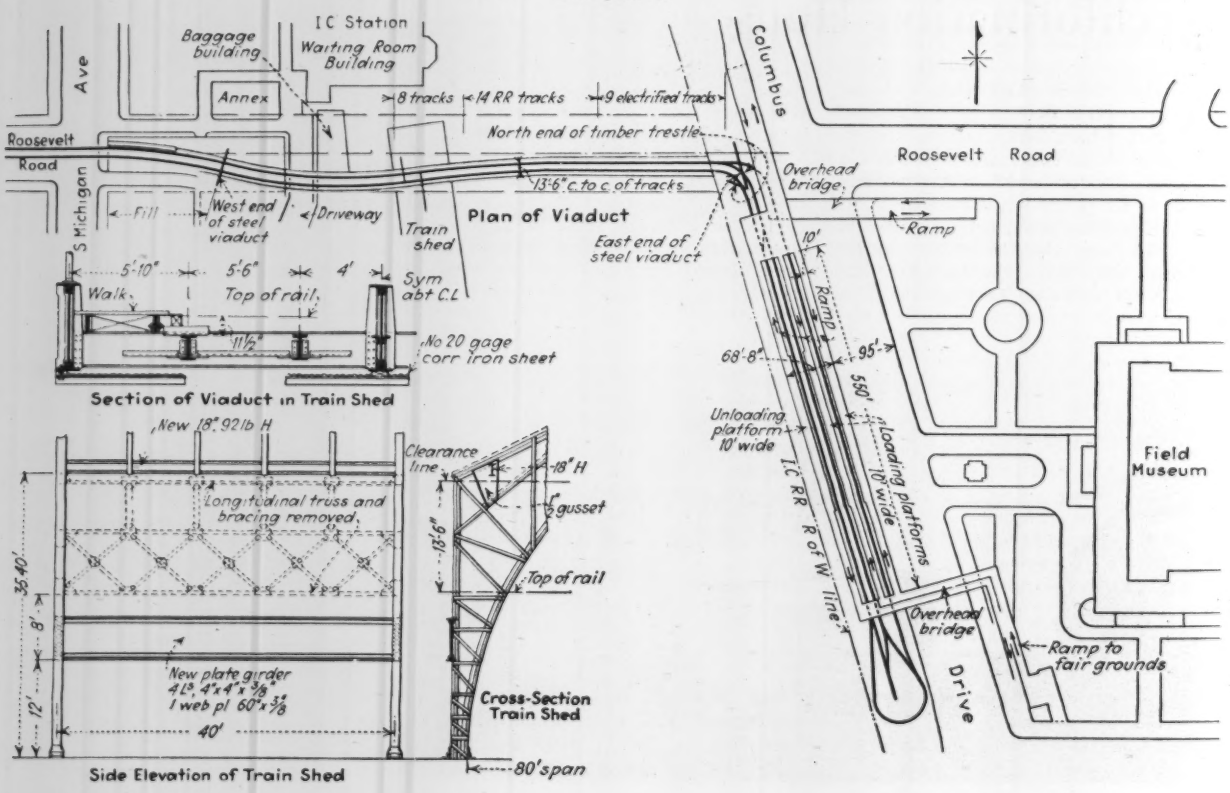
Commencing at the east curb of Michigan Ave., the Roosevelt Road double track rises to the east on a short filled approach to a steel viaduct which continues through the passenger trainshed of the Illinois Central Railroad, passing over eight tracks. The grade up to the trainshed is about 5.8 per cent and through the shed is 1.12 per cent. East of the trainshed the viaduct crosses (at a height of about 20 ft.) fourteen freight and passenger tracks and nine electrified suburban tracks. At the east end of the steel viaduct the structure makes a right-angle turn to the south, proceeding on 800 ft. of pile and timber trestle to a loop and switchback. From unloading platforms on the trestle, ramps and stairways lead to two foot-bridges, permitting pedestrians to cross over the congested automobile traffic of the Outer Drive without interference and thence to go directly into the fair grounds.

The Illinois Central Railroad at this point operates one of the busiest terminals in Chicago, and all work had to be scheduled so as not to interfere with train operations. At the same time extreme vigilance and careful planning were required to prevent accidents to trains and workmen. A particularly dangerous section was the electrified suburban track area, where trains move swiftly and give little warning of their approach. In spite of the difficulties and dangers, there was only one minor accident to a workman throughout the construction period, a large part of which was necessarily night work.

Construction was commenced at half a dozen points simultaneously, as follows: (1) filling at west approach; (2) moving, building, dismantling and rebuilding the interfering parts of existing structures; (3) excavation and concrete work for viaduct footings; (4) relocation and replacement of sewer and water lines, including shoring and supporting railroad tracks; (5) pile driving and timber work for 800 ft. of pile trestle; (6) cutting out existing pavement west of the viaduct structure, laying car tracks and erecting trolley wires.

Sewer and Water Work—Existing water and sewer lines were relocated to avoid foundation footings. This required tunneling underneath and supporting a majority of the tracks in the terminal area. An 8-in. water line, the sole fire protection for the valuable exhibits of the Field Museum, was relocated for half its entire length of 600 ft. In this operation the water supply was cut off for about one hour at midnight to make final connections.

Foundations — The viaduct columns rest on sixteen pairs of spread footings, all but five pairs of these lying between tracks, with a minimum of lateral clearance. All excavations were timber-sheeted and braced to prevent settling and possible failure of track supports.



Street-railway viaduct over Illinois Central R.R. tracks and through trainshed on extension of Roosevelt Road line to World's Fair grounds.

Concrete and excavated materials were carried to and from footing locations in 1-yd. dump tractors over plank runways laid between tracks. Interfering water and sewer lines were supported through excavations, and in some instances they were concreted into footings before water and sewage were diverted to the new lines. Special precautions were taken to prevent accidents to railway patrons, employees and workmen; open excavations were covered and protected by lights and barricades wherever required.

Steelwork—Within eighteen working days after the start of the operations outlined above, the first carloads of the 500 tons of steel were delivered to the site. Steel erection over steam tracks was by locomotive crane. Erection over the electrified suburban tracks was by means of a rolling derrick mounted on top at the east end of the structure. A 10-ton truck-crane erected and dismantled the derrick. The steel-raising gangs worked only for limited periods, day or night, as called for by the schedule of arriving and departing trains and railroad switching movements. However, all steel was erected without accident and within ten days after receipt of the first shipment. Completion of the work then consisted of painting, laying narrow wooden sidewalks for emergency use on the steel viaduct and follow-up of track and overhead trolley construction by the street railway companies.

The first regularly scheduled passenger car ran over the structure on Aug. 1, just 30 working days after the first spadefull of dirt was turned.

The cost of the entire work to the city was $71,135.47. The balance of the expense, $250,000, was borne by the Chicago Surface Lines Co. and the Chicago City Railways Co. The average number of men employed daily on construction work by all interests was 150. As many more were employed in shops, yards and mills.

Mayor E. J. Kelly, in his dual capacity of mayor of Chicago and president of the South Park Commissioners, personally conducted the preliminary negotiations with the various intersts to expedite the work. Oscar E. Hewitt, commissioner of public works, supervised the contract. William Artingstall acted as consulting engineer to the commissioner, and the Ketler-Elliott Co., of Chicago, was general contractor.

Copious Artesian Supply Serves Entire Township

Many communities organized into water districts to take advantage of large amount of water encountered in new well field

By F. J. Keis
Solomon & Keis, Consulting Engineers, Troy, N. Y.

PLANNED originally as a project to supply water to a small community of 600 people, the Latham water district, in Albany County, N. Y., as a direct result of the copious amount of pure artesian water encountered in the development of a new well field, has been rapidly expanded to a system that will cost more than $700,000 and will serve nearly all of Colonie Township. As planned in 1929, the system was to include 5 miles of water mains, a 100-g.p.m. pump and a 50,000-gal. tank; the project in its present form is to include 55 miles of water main, four pumping stations, one booster pumping station and four elevated tanks having a combined capacity of 800,000 gal. Upon completion, the system will practically interconnect the Albany, Schenectady, Cohoes and Watervliet water systems. The area now served extends about 8 miles north and south and about 11 miles east and west.

The Latham water district lies between the cities of Albany, Schenectady, Cohoes and Watervliet. It was organized in 1929 to serve Latham, a community having a population of about 600, located 5 miles north of Albany. The original plan called for an appropriation of $66,000, a 6-in. distribution main, a 50,000-gal. steel tank and a pumping station equipped with one 100-g.p.m. pump that was to obtain water from a well in the artesian strata nearby.

About 35 years ago, while government engineers were engaged in making test borings along one of the proposed routes for the New York State Barge Canal, they encountered a flow of artesian water 5 miles north of Albany and 5 miles west of Troy. Later the city of Cohoes drilled some test wells in this area, and several flowing wells were developed. They were utilized, however, only to supply water to the near-by Shaker community.

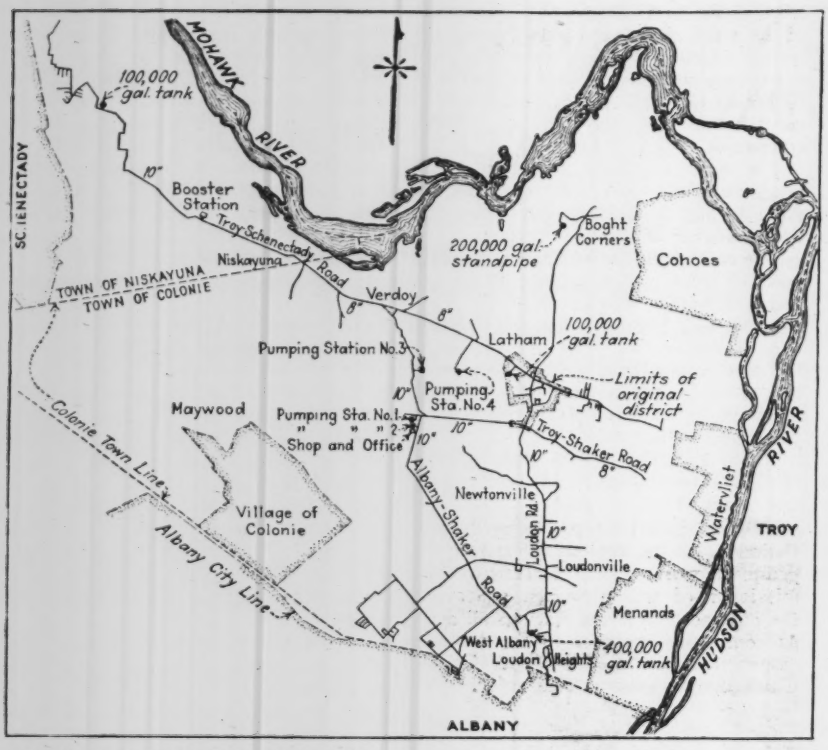
The possibility of using this artesian field for the Latham supply led to an intensive study of its potentialities. A study of the geology of the area between the Hudson and the Mohawk Rivers shows that the pre-glacial Mohawk flowed easterly from South Schenectady and discharged into the Hudson at Albany. Its channel was intersected by another channel at West Albany, which extended northerly through Round Lake and Saratoga Lake. The glacial and post-glacial areas of these old channels received large deposits of sand, gravel and boulders, which later became covered with heavy blue clay deposits during the lake stages formed by the melting glaciers. It was thought possible that some of these beds of sand and gravel were now being supplied with water either along the old channels or from the adjacent higher ground.

The site for the first test was selected near where the artesian flow was first discovered. A well rig was moved in during December, 1929. The well developed a static head of 5 ft. at the ground surface and could have been used to produce about 50,000 gal. of water per day. A second test well 1¼ miles to the south also showed a large supply of water available, standing within a few feet of the surface.

From the information derived from these test wells the proper location for a producing well was established. At the location selected the drill encountered 53 ft. of surface sand, 73 ft. of blue clay and hard-packed sand, 80 ft. of blue clay and gravel at a depth of 206 ft. When the drill penetrated into the gravel, in May, 1930, a stream of water, mud and gravel rose into the well rig. After capping and measuring the flow it was found that this 6-in. well had a static head at the surface of 18 ft. and discharged 460,000 gal. per day. The water was of excellent quality with a temperature of 42 deg. F.

A second well was driven 25 ft. away through practically the same material. The two wells together, flowing under their own heads, produce 867,000 gal. per day. An interesting feature of the wells is that the bottoms of the strainers are 57 ft. above the level of the Hudson River, and the static head raises the water 313 ft. higher than the level of the Hudson and 123 ft. higher than that of the Mohawk.

The available supply was now greater than that required for the district, and the wells attracted much attention and aroused the interest of neighboring communities. Applications were received from residents on the Shaker Road, Newtonville, Loudonville and from several hamlets on the Troy-Shaker Road to be included in the district. In the meantime construction had been under way on the original system, but the design had been revised to use a 100,000-gal. tank at an elevation 50 ft. higher than that in the original plans, and the supply main was increased to a 10-in. diameter. The two wells were cross-connected and a pumping station was built between them. Two horizontal, motor-driven, centrifugal pumps, of 300- and 400-g.p.m. capacities respec-



Nearly all of Colonie Township is to be supplied with water from an artesian field that was developed originally to serve only the village of Latham.

tively, were installed to operate under automatic control. The larger unit was also equipped with a gasoline engine for stand-by service.

The 10-in. supply main was extended along the Loudon Road to Newtonville and Loudonville, and an order was placed for an additional 200,000-gal. tank for the Loudonville section. Another well was also authorized and a contract was let to the original driller, the Layne-New York Co.

Work was hardly begun on these extensions when applications were received from other communities, including West Albany and Verdoy on the Troy-Schenectady Turnpike adjacent to the Schenectady County line. The potentialities of the district, however, had been realized after the development of the first two wells, and a comprehensive control plan was drawn up for the major portion of Colonie Township, which covers about 52 square miles.

The order for the 200,000-gal. tank was changed to the one for a 400,000-gal. tank, and necessary revisions were quickly made in the piping system to conform with the new plan. At first, before the general plan had been prepared, the growth of the district was so rapid that in a few instances the pipe, after being distributed, had to be moved to new locations to make way for a larger pipe, but at no time was it necessary to abandon or change any pipe after it had been laid.

Test drilling was again begun about ¼ mile to the west of the developed wells, but no appreciable amounts of water were encountered. To expedite matters, a rotary-type well rig was placed on the job and it made excellent progress through the sand and blue clays. Some of the cuttings from this rig appeared to be either sandstone or a very closely packed sand. It was finally decided in regard to one hole about 600 ft. south of the flowing wells that the material was closely packed sand, and accordingly experiments were conducted by washing and backwashing the hole with clear water. This was carried on for about ten days without success. A few hours before the time set for abandoning the test, the water broke through and the well flowed about 500,000 gal. daily.

In the meantime pipe-laying was progressing with two to four trenching machines in use, and another well rig was operating to the north. Water-bearing gravel was again located in that area, and a well was developed to yield about 175,000 gal. daily, under a static head of 6 ft. at the ground surface.

Additional applications for extensions were received from the West Albany area and from Niskayuna, a community near Schenectady, and also from Boght Corners, several miles north of Latham. The Niskayuna area was formed into a separate district, and the mains are now being laid. A 100,000-gal. tank is being erected there and, because of the district's higher elevation, a booster pumping station is being built to raise the water an additional 100 ft. Another 200,000-gal. tank was erected at Boght Corners, and additional feeder mains were laid.

Because of low construction cost enough money had been saved on the well-drilling to provide one more well and, after additional testing, water was located at a depth of 150 ft., about a mile north of pumping station No. 1. The well has a static head of 26 ft. and flows about 750,000 gal. per day.

Water from well No. 1 is pumped by two horizontal motor-driven centrifugals; from well No. 2, by a 500-g.p.m. deep-well turbine; from well No. 3, by a horizontal motor-driven centrifugal of 750-g.p.m. capacity, equipped with both electric and gasoline motors; and from well No. 4, by a 125-g.p.m. deep-well turbine. Installed pumping capacity now totals 3 m.g.d. All pumps are under automatic control and are set to function during off-peak power periods so that current can be purchased at minimum rates. The automatic controls are also arranged to function without an operator in the event of fire or emergency.

No operators are required in any of these pumping stations. They are visited daily by the superintendent, who checks and oils the equipment. Two stations are heated by gas and two by oil, all under thermostat control. The distribution system is 100 per cent metered.

The well sites range from 4 to 10 acres. They have been attractively landscaped, and about 12,000 pine trees have been planted. A garage, shop and office have been built near station No. 2.

The wells were drilled by the Layne-New York Co. Construction work was under contract by Barone Bros., W. G. Fritz & Co., Frank G. Blair & Sons, G. Ferullo, Inc., and A. Stanley Mundy & Co. The pumping stations were built by Cassabonne & Maloney, and Folan & Hannigan. The work was designed and supervised by Solomon and Keis, consulting engineers, Troy, N. Y. N. S. Holroyd was resident engineer.

All of the territory served is rural or suburban. The project has been financed by the sale of 20- and 30-year bonds bearing 4¼ per cent interest. The affairs of the district are administered by a board of water commissioners composed of Franklin H. Austin, chairman, Sylvester H. Denison, treasurer, and Charles C. Wing, secretary.

Air Delivery of Road Materials

Faced with an accrued penalty in the fulfillment of an important highway construction contract, the firm of A. H. Cox & Company, of Seattle, Wash., turned to the air express as a last resort for delivery of a box of road-machine parts weighing 96 lb. from a plant in Milwaukee. The shipment moved from Milwaukee by Railway Express plane, taking off at 6.25 p.m. and reached Seattle, after a 2,303-mile flight, at 4.25 p.m.—exactly 22 hours.

Decentralized Civil Works Program to Supplement PWA

All work is to be done on day-labor plan—Operating and maintenance work excluded — CWA will pay PWA wage rates—Semi-skilled rates not fixed as yet

QUICK EMPLOYMENT of 4,000,000 men on work-relief projects throughout the country is the sum and substance of the civil works program that was launched by the federal government ten days ago and that went into operation this week. It will spend about $600,000,000 between now and Feb. 15, when the program is to terminate unless continued by Congress. Of this sum $400,000,000 is an allocation from the PWA fund (which thereafter had a balance of only $580,000,000), while $60,000,000 is to be contributed from Federal Emergency Relief Administration funds and $130,000,000 is expected to be contributed by states and local governments.

Specific policies and rules to govern this great program were announced and in part developed from the ground up in a series of conferences of the new Civil Works Administration (which in personnel is the same as the Federal Emergency Relief Administration—Harry L. Hopkins, director) with state and city representatives at Washington last week. The result of the conferences indicates that the undertaking will go through substantially as planned, that it will not conflict with the Public Works Administration, and that in scope it supplements the latter. Administrator Hopkins, in his brilliant conduct of the conferences, displayed intimate knowledge of unemployment conditions and a remarkable ability to make quick decisions on policies.

In short, the 4,000,000 men and women who are to be given employment between now and the middle of February will be put to work, will carry on useful activities producing lasting results, on wages sufficient for self-support, and will not loaf or do wasted work. Expenditure of the fund will include tools and materials. Present estimates are that nearly $100,000,000 will be required for this purpose, while wages at an average rate of $50 per month will be paid to 2,000,000 men for three months and to another 2,000,000 for two months. Important elements of the program as brought out by the Washington conferences are noted below.

Purpose and relation to PWA

The civil-works program does not imply waning confidence in the public-works program as a sound policy of support for industrial recovery but rather a realization that construction of substantial public improvements is not compatible with hasty action, and that because of the small amount of employment that it has produced the relief demands this winter will be heavier than last winter. An increase of a million people in relief is forecast for this winter. For this reason it is proposed to provide

Harry L. Hopkins, CWA Administrator

real jobs and a real wage for a large proportion of those who otherwise would require relief.

Harold L. Ickes, administrator of public works, describes the civil-works program as a stop-gap until the full effect of the public-works program is felt. The PWA, he says, is struggling under handicaps that have limited actual expenditure of funds to $112,098,000, as of November 14, although only $580,000,000 of the original $3,300,000,000 remains to be allotted. "I don't know whether we realized at the beginning how difficult it would be to get this money to work. People were expecting miracles and I suppose we were too," said Administrator Ickes.

The civil-works program will not be permitted to encroach upon the public-works program. Projects submitted to the PWA may not be withdrawn for the purpose of offering them as civil-works projects. This aspect of the CWA is not pleasing to municipalities which contend that they undertook PWA projects primarily as an unemployment relief measure. Such dissatisfaction prompted introduction of a resolution at a meeting called by the U. S. conference of mayors on Nov. 15, which would have advised municipalities to drop PWA projects; but the resolution was not submitted to a vote, and Administrator Ickes later reiterated that the only PWA projects which CWA will consider are those whose character seems to be more suitable to CWA and are referred for that reason. State PWA boards have been instructed to review their lists with this in mind.

Speed the prime objective

Speed in getting the program under way is the prime consideration. The CWA will decentralize completely; responsibility for approving projects will rest on the state CWA's. Speed will also control selection of projects. Large projects therefore are impossible, and the program is limited to small work that can go ahead immediately.

Kinds of work

Administrator Hopkins stated that garbage collection, street-cleaning and snow removal will *not* be permitted as part of the program; projects must be useful, producing a permanent result, but must not fall in the field of PWA construction. No city halls, schools, state institutions or sewage-disposal plants will be built. The line of demarcation from PWA projects will be definite, though it cannot be stated in short and definite form. Suitable projects are park and playground construction, feeder roads, road repairs, water-main and sewer extensions, building repairs, excavation work, etc.

Special projects will be sought for the employment of professional men such as architects and engineers and skilled workers. Projects for women are also to be developed. Mr. Hopkins stressed the dependence of the CWA program on the resourcefulness of the local officials, especially in finding and developing projects of the latter type. No funds will be available for buying land.

The CWA abandoned its original intention to set a cost limit on projects. Rather than permit local projects below a certain amount to be initiated without some check, the regulations require approval of all projects by the state civil-works administrations. In order, however, to capitalize the speed permitted by a decentralized organization, approval of projects by the federal administration is not required. A copy of every project proposal must be forwarded to Washington, and the federal administration reserves the right to intervene at any time. State projects will be submitted direct to state administrations, and federal projects will be re-

viewed by the administration in Washington.

Wage rates

The regular PWA wage scale constitutes the minimum rates to be paid on all civil projects except road work, where the rates fixed by state highway departments apply. On all other projects skilled labor will receive the zone rates of $1, $1.10 and $1.20, and common labor 40, 45 and 50c. per hour respectively in the southern, middle and northern zones. Work is limited to a 30-hour week. The men will be paid by check from the local offices of the Veterans' Administration. Provision will be made for workmen's compensation. Intermediate wage rates, if any, will be determined in accordance with local conditions by the state and community administrations. Regulations include the broad PWA requirements that "The maximum of human labor shall be used wherever practicable and consistent with sound economic and public advantage." This does not prohibit the use of power equipment when the character of the project indicates its use, according to Mr. Hopkins.

State quotas

Federal funds for civil works will not be allocated among states or cities according to fixed quotas, as Mr. Hopkins asserts that this would "stymie" the whole program. State and local communities are expected to contribute, and the amount allocated by the federal administration will be determined by the extent of such cooperation considered in the light of the political subdivision's ability to cooperate. Communities without resources will not, however, be penalized because of their condition.

State civil-works administrations have been assigned quotas computed by giving the number now on relief rolls a weight of 25 per cent and the total population of the state a weight of 75 per cent. State quotas thus computed are listed below.

On the basis of national estimates 2,000,000 men are now on work relief. These men will be transferred automatically to civil-works payrolls. The third million now on direct relief will be cleared through the federal re-employment offices to state and local projects. A fourth million drawn from the register of federal reemployment agencies have been tentatively reserved for federal projects. As the present estimate of men for which employment can be found on federal work is only 500,000, the state and local civil-works administrations may be called upon to absorb the surplus.

In the final analysis the success of the civil-works program rests upon local authorities. Complete responsibility is vested in state and community divisional administrations whose personnel has been drawn to a large extent from existing relief administrative units appointed by Washington but familiar with local conditions. In developing useful work programs, the civil-works administrations have been instructed to obtain the cooperation of regular operating departments in charge of highways, streets, water, sewage and other public services.

STATE QUOTAS FOR THE CWA PROGRAM

States	No. of Employees	States	No. of Employees
Alabama	70,500	New Jersey	90,000
Arizona	11,250	New Mexico	8,250
Arkansas	48,750	New York	297,000
California	132,750	North Carolina	67,500
Colorado	24,750	North Dakota	12,750
Connecticut	35,250	Ohio	165,000
Delaware	6,000	Oklahoma	76,500
District of Columbia	12,000	Oregon	21,000
Florida	52,500	Pennsylvania	253,500
Georgia	62,250	Rhode Island	13,500
Idaho	10,500	South Carolina	49,500
Illinois	186,750	South Dakota	17,250
Indiana	74,250	Tennessee	56,250
Iowa	53,250	Texas	143,250
Kansas	45,000	Utah	12,750
Kentucky	69,750	Vermont	7,500
Louisiana	54,000	Virginia	48,750
Maine	15,750	Washington	37,500
Maryland	35,250	West Virginia	52,500
Massachusetts	96,750	Wisconsin	67,500
Michigan	120,750	Wyoming	5,250
Minnesota	55,500	Tentative	
Mississippi	50,250	Alaska	1,500
Missouri	76,500	Hawaii	7,500
Montana	13,500	Puerto Rico	30,000
Nebraska	27,750	Virgin Islands	3,000
Nevada	3,000	Total	3,000,000
New Hampshire	10,500		

District of Columbia procedure

An example of such coordination is the work program planned in Washington, D. C. Approximately 14,000 families are on Washington relief rolls. About 11,000 members of these families can work. Since August, 1932, they have been employed on a variety of work-relief projects on a two-men-to-a-job basis, which is half-time at a wage of $2.80 for an eight-hour day. Since its inception the payroll has climbed from $10,000 to $50,000 a week, with one interruption due to exhaustion of funds. Notable among the projects built on the work-relief basis is the Roosevelt High School stadium, dedicated Nov. 17. This has employed an average of 100 to 125 men since August, 1932. The structure is of fir with concrete ribbing and has a capacity of 2,500 persons. It was built entirely on force account.

When President Roosevelt announced the civil-works program, District of Columbia officials immediately prepared a schedule of projects to employ its CWA assigned quota of 12,000 men immediately and 15,000 men at an early date. This program includes projects on both District of Columbia and federal property, to be covered by an allotment of $3,458,241. Trucks would be rented from contractors who are putting their equipment in storage for the winter. All departments of the District government participated in setting up the program.

Indiana work under way

By virtue of rapid assembling of available work on the part of the authorities in Indiana, considerably more than 100 projects are under way. Statistics at hand at the time of going to press showed these early jobs to be distributed among seventeen counties and twelve cities. This program will give work to 11,000 men (3,800,000 man-hours) at an expenditure of $2,300,000 for wages and $235,000 for materials. Thus materials account for between 9 and 10 per cent of the total expenditure.

The work that Indiana has under way is indicative of that which is eligible for CWA funds. In the counties roadwork consists of grading, graveling, widening, bridge repairs and ditching. Earthwork and drainage involve an airport, small-stream flood control and general drain-cleaning and improvement. County jobs are also being provided in repairing buildings such as schools and court houses. The city work includes sewer repairs and extensions, tree trimming, cleaning sewage-plant appurtenances and grounds, widening and repairing streets, improving parks, stream cleaning and bank grading, extending city water mains and repairing sidewalks. Levees are being built in Indianapolis, and a river retaining wall is on Mishawaka's program. Many city building repairs are included. In Michigan City the cemetery is being landscaped and a ravine is being filled.

Letters to the Editor

Verde River Development Work

Sir—In the Sept. 28 issue of *Engineering News-Record*, p. 394, there appears a news item entitled "Verde River Program Opposed by Salt River Association."

As this news item gives an incomplete picture of the situation regarding this important project, it is only due your readers that the actual facts regarding it should be published. I am therefore asking you to print in your columns the following concise statement of facts regarding the Verde River irrigation and power project.

The project comprises about 100,000 acres of land in Deer and Paradise Valleys, a few miles north of Phoenix, Ariz. It is estimated that about 85,000 acres of this land can be brought under irrigation.

This land, situated in two beautiful valleys almost entirely surrounded by mountains and now covered with a luxuriant growth of desert shrubs, is by reason of the character of the soil and the high minimum temperatures that prevail, highly adapted to the cultivation of citrus fruits.

The Verde River Irrigation and Power District was organized in 1918

and has acquired all of the rights to the unutilized waters of the Verde River and also rights-of-way for dam sites and canals.

Observations covering a period of 27 years show that the average annual floodflow of the Verde River available to this project, and to which they have the sole and unquestioned title, is more than adequate for all the requirements necessary to its successful cultivation without taking into consideration the additional supply available from the groundwater after a few years.

The Salt River Valley Water Users Association is entitled to the normal flow of the river and to as much of the floodflow as they can put to beneficial use. They have no other right to the floodwater, which now flows off without being utilized to any great extent.

The Verde River project has been passed upon favorably by the U. S. Reclamation Service, and after a meeting here in Phoenix attended by P. J. Preston, W. W. Lane and H. S. Reed, constituting a board of engineers, the Salt River Valley Water Users Association was given every opportunity to present its case in opposition to this project. The above-mentioned board of engineers gave their unqualified approval to the construction of the Verde River irrigation and power project, and so reported to the Public Works Administration at Washington. The Salt River Valley Water Users Association has no right to any of the waters of the Verde River except as stated above, and the development of the Verde River irrigation and power project cannot injure them in any way and in all probability will ultimately be a benefit. Although the development of this project at this time would be a great advantage to the community, nevertheless they maintain an attitude of bitter opposition and even entertain the idea that they can develop the Verde River for their own benefit with entire disregard of the rights and interests of those who now hold sole title to the waters and the rights-of-way for dam sites and canals necessary for its conservation and use.

Phoenix, Ariz., Oct. 5, 1933. LOUIS H. SHOEMAKER.

Recovery Construction

Sir—Your editorial entitled "Uncle Sam as Santa Claus" indicates that in your perhaps pardonable enthusiasm for the development of construction enterprises you overlook certain basic factors which cause municipal and possibly state officials to hesitate before increasing their bonded indebtedness and subsequent taxation.

Governor Roosevelt, Governor Lehman and many others have taken the municipalities particularly to task for their past extravagances in borrowing and piling up debts which now, in these times of stress, they are finding difficulty in paying.

The depression has caused a lowering of real estate values and a material lowering in the ability of taxpayers to pay taxes. It is well, therefore, that we should hesitate before incurring additional taxation burdens and even, as the Hon. Mark Graves, chairman of the New York State Board of Taxation and Finance, said only a few weeks ago, "Look with suspicion on any proposals to increase the funded debt of our municipalities."

There is probably a great deal of work to be done which can be profitably done at this time, but it is very doubtful if engineers should be so lacking in proper judgment as to advocate or condone spending just for the sake of spending. I don't believe you mean to do this, but the editorial referred to and some others in recent issues seem to lean in that direction.

New York, N. Y., Oct. 13, 1933. F. LAVIS.

THE EDITORIAL in question was not intended to advocate "spending just for the sake of spending." It expressed the view that local communities should avoid seeking to exploit the national government for the satisfaction of local needs. This view does not conflict with proper economy aims in local government. But in considering the meaning of local economy, it must be borne in mind that the country is now committed to the plan of reviving wage distribution, purchasing power and the resultant normal activity of industry and business by a great construction campaign, in which every community is expected to join in order that the plan may be assured of success. True economy under these conditions would appear to lie in furthering the campaign and cutting down the alarmingly high relief-roll expenditures by substituting wages for relief and thereby aiding the course of recovery. The public-works fund was made available by Congress for this purpose, under definitely specified conditions of local cooperation. Communities that seek to obtain 100 per cent grants to avoid meeting these conditions are manifestly not giving their proper share of cooperation. —EDITOR.

Composite Piles

Sir—With reference to the article (*ENR*, July 13, 1933, p. 39) illustrating concrete piles for capping on to round timber piles, a somewhat similar reinforced-concrete pile top was developed in Victoria by the Harbour Trust and has been used in the foundations of the Swan Reach bridge (*ENR*, May 11, 1933, p. 596). It will be noted that the piles are hexagonal.

On this bridge the timber pile was first driven until its top was approximately at the bottom of the leads. The sapwood was then removed for a distance of a few inches greater than the 4-ft. length of the cavity at the bottom of the concrete pile.

A band of hessian about ½ in. thick was wrapped round the trimmed portion of the timber pile before the concrete pile was seated on top. This hessian prevented the cement grout, poured between the timber and concrete piles, from escaping. When no further grout could be poured into this space, the pile was given a few blows of very small drop, which expelled the surplus grout and gave the concrete pile a good bearing on top of the timber pile.

The composite pile was then driven immediately, before the grout had set. In all, 88 composite piles were driven in this structure. The timber-pile portions were from 55 to 60 ft. long, while the concrete piles varied from 12½ to 30 ft.

It may be noted that the general practice for this particular bridge was to use timber piles from a depth of 6 ft. below mud line, and from that point up to low-water level to use the reinforced-concrete piles as columns. Piles were driven in groups of four, and a concrete cylinder, 7 ft. in diameter and 3 ft. high, was cast around each group of piles, with the top of the cylinder at mud level. In the accompanying photograph the concrete pile is shown blackened except for the area which was incased in this cylinder and at the top. It was found that the most satisfactory method of treating these concrete piles, which were exposed to brackish water, was to give them a prime coat of crude tar and subsequently to paint them with a heavy coat of bitumen cut back with kerosene.

W. T. B. MCCORMACK, Chairman, County Roads Board.
Victoria, Australia, Aug. 25, 1933.

Towing a 3½-ton concrete pile to a pier location on the Swan Reach bridge in Australia. This pile fitted over a timber pile of 55- to 60-ft. length driven to below the mud line.

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Intensified Responsibility

FURTHER indefinite delay faces the construction codes as a result of the suddenly called NRA rehearing, held at Washington last Monday. The outcome makes it clear that the officials of the National Recovery Administration have even greater responsibilty than appeared previously (see *ENR*, Nov. 9, p. 573). Hostility and selfishness of some of the labor union leaders stood out prominently, and forecast that it will be hard to reconcile their claims with the requirements of a sound system of code self-government. A promising thought appeared only in the proposal of William Green, president of the American Federation of Labor, for a joint planning board bringing together finance, realty and labor with professional men, contractors and materials interests—a proposal already advanced in other quarters. For the rest the union representatives ignored the defining characteristics of the construction market and treated the problem as one of fixed demand irresponsive to the cost burden. The NRA obviously cannot wait indefinitely for antagonistic views to come together. It may have to display courage, and approve or decree a code without waiting for everyone's consent.

Direct Action for Employment

ANY APPRAISAL of the revolutionary movement represented by the Civil Works Administration must first of all recognize that it is direct action to create employment throughout the country during the winter months, and that in this light it constitutes rejection of the belief still held by some that the cheapest and quickest way out of the depression is by doles. In this sense the CWA is a parallel to the public-works movement which, after a long fight, found expression first in the 1932 Emergency Construction Act and later in the 1933 Recovery Act. It will be remembered that these measures had the purpose of starting up a gush of construction employment, to give starting momentum to the industrial machine. Only a trickle resulted. The expectation of last June that Recovery Act construction would employ several million workers by winter was disappointed by political delays, unwillingness to decentralize and the increasingly severe credit stringency of local communities. Secretary Ickes last week confessed that "perhaps we expected miracles." He has not been able to work these miracles, but perhaps Harry L. Hopkins will do so with his more direct weapons. At least his incisive statements of policy at the Washington conferences last week give assurance that the attempt will have a high degree of success. The plan should not clash with the PWA program, for the work to be done is of a kind not well suited to the loan and repayment requirements applied to the latter. It leaves the PWA field undiminished and lays added stress on the importance of concentrating effort on prosecuting PWA work intensively, pushing winter construction, and making sure that by February or March the PWA program will be moving ahead under full power.

Farsighted Measures

THE CLEARNESS of vision of those back of the CWA movement is evidenced not alone by the plan itself but more particularly by two detail provisions—that CWA funds will be used for materials and tools as well as for labor, and that special effort will be made to include projects adapted to the employment of engineers, architects and skilled workers. Projects on which women can find employment are also to be developed. Administrator Hopkins understands the spreading-out possibilities of utilizing the program to create more than merely job labor, for in answer to a query as to whether tools on hand in arsenals might be loaned by the government he expressed the wish to see tools and equipment bought. So also his reference to the importance of providing work opportunities suited to professional men shows that he is aware of the high degree of unemployment in this field. The responsibility of local engineering officials and other officials in helping to make the CWA program a success, which we pointed out last week, received strong emphasis in the full statement of the program.

Aluminum Bridge Floors

THE STRONG ALLOYS of aluminum that have found effective use in a variety of ways during the past few years scored a notable advance in being chosen for a new light-weight floor on the Smithfield St. Bridge in Pittsburgh. An advance for aluminum, this installation represents progress in structural engineering as well. Previously the outstanding uses of structural aluminum have been in a number of overhead traveling cranes and in the framework of the conservatory at the U. S. Botanic Garden in Washington. These installations, while furnishing many valuable data concerning the advantages of weight-saving and corrosion resistance, are hardly comparable, in the structural engineer's mind at least, to a major bridge floor. The Smithfield St. Bridge job really marks the advent of aluminum in the structural field. The introduction is auspicious, as the article in this issue makes strikingly plain. Light-weight floors have been a desideratum of bridge design for years. The asphalt-surfaced battledeck-type floor of the Smithfield St. Bridge, weighing only 30 lb. per square foot, goes a long way to meet this basic need.

Stronger Steel

YEARS of hard work and sympathetic cooperation on the part of steel manufacturers and engineers have finally borne fruit in specifications for stronger steel for bridges and buildings. They require 60,000 to 72,000 lb. per sq.in. ultimate strength, with yield point from 33,000 to 36,000, compared with 55,000-65,000 ultimate strength and 30,000-33,000 yield point in the old specifications, which are retained only for steel used in general plate construction. Stronger steel has been possible for many years and is, in fact, in use generally throughout Europe. The new specifications, therefore, are in line with progress, and may be said to represent the belief of steel manufacturers that no great difficulty will be encoun-

tered in compromising the requirements of strength and ductility. To the user the stronger steel promises a greater safety factor, if present working stresses are retained. However, because of excellent uniformity in structural steel, higher safety factors are not a vital need. Granted a reasonable spread between working loads and ultimate strength or yield point, the greatest present necessity is for maximum economy in the use of steel. A committee of the American Society of Civil Engineers, in fact, recommended a 20,000 lb. per sq.in. working stress for the 55,000-65,000-lb. steel. The present 18,000-lb. stress, representing a compromise between the old 16,000- and the 20,000-lb. stress, gave a factor of safety, based on minimum yield point, of about 1.65. The same safety factor is possible under the new specification using a 20,000-lb. stress.

Labor Classification

CLASSIFICATION of construction labor, as a basis for defining minimum wages, becomes urgent as contracts involving Recovery Act funds are awarded and men begin to be hired. Neither the Public Works Administration nor the organizations representing construction have squarely attacked the problem. The classification of labor as skilled and unskilled, so far announced as a basis for wage rates, is meaningless and opens the door for limitless dispute between labor and its employers. To avoid this even in a measure requires that the classes of occupations be specified and listed. In fairness also to a large group of construction labor the number of classifications should be increased to include the worker who neither commands the pay of the skilled artisan nor should be penalized by the wage rates of common labor.

Unless steps are taken at once properly to classify labor, endless wage-rate disputes will confuse and disrupt the construction program now struggling along. The classification will in some degree be arbitrary, but so was the decision on the wage rates that has been promulgated from Washington.

The work to be done largely determines the standing of the workmen engaged. A skilled worker is an artisan whose training and ability enable him to perform tasks impossible to those not so trained and so capable. When engaged on any work requiring the service of an artisan, the mechanic so employed is entitled to a skilled classification. At the other extreme lie the menial and heavy tasks on construction requiring only brawn and a knowledge of how to work. Between these two ranges lie a great number of tasks requiring some degree of intelligence and training on the part of the worker to perform, but not demanding the services of a skilled worker. Definite provision must be made for this important class of workmen, but it must be based on common sense.

Wheeling brick is the same task whether the brick are being moved from a box car to storage or direct to the bricklayer's scaffold. Contention that the latter task classifies the wheelbarrow runner as a bricklayer's helper, ordinarily classed as semi-skilled, is absurd. Nor does a stillson wrench in the hands of a man who is tightening up a two-inch water line make that laborer a plumber, and cutting off twelve-by-twelves for a cofferdam framing is hardly to be classed as finished carpentry.

There is a logical and just classification for every construction task, and it is the immediate duty of labor, employers and the Public Works Administration to decide on and announce it. None of them has realized its obligations. Individual federal construction agencies, including the Bureau of Public Roads and the corps of engineers of the army, have alone attempted to define a labor classification. Until such classification is made for the public-works program in its entirety, confusion and impeded progress will prevail.

Development Ahead

THREE years ago the Construction League was established to bring together the heads of construction's principal operating departments and, through the medium of mutual acquaintance and the joint consideration of the industry's problem which this new agency would permit, to develop a working spirit of partnership in the common undertaking of carrying out construction. A simple and effective form of organization was formed to this end. No elaborate structure was necessary, since free conferences best served the purpose in view. The effort was successful, and a large measure of unity of spirit and purpose was attained. Because of this preparatory work the league was able to conduct the important work of the National Committee on Trade Recovery during the past year and more recently to take the lead in drawing up codes for the industry.

Present conditions place upon construction a more definite organizational responsibility. Construction is now required and given opportunity to undertake self-administration and self-government, and, while the official functions of this service will be performed by a code authority, it is quite apparent that a close-knit and efficient industry association of construction forms the indispensable background and auxiliary of such an authority. The Construction League is the pre-ordained nucleus of such a trade association, and it is therefore called upon to abandon the simple ways which it has followed heretofore and make ready for larger duties.

That the league is conscious of its new responsibility was clear from the attitude of its delegates at the Washington meeting last week. Converting a league of interrelated trade associations into an autonomous body of thoroughly organized structure, equipped with personnel and organization to carry out its important service functions to the industry, is not a simple matter, but the change is inevitable. The essential duties of every trade association to its field, including statistical and economic study, research, adjustment of inter-industry problems, public information and many others, are needed by construction even in greater degree than by industries of less complex make-up.

Development of a complete organization and constitution of the reconstructed league should be completed within the next two months, so that the operations of the new league may begin with its January meeting. Under a code system the guiding authorities will have urgent need of the support which the more fully organized league is to furnish. And, on the other hand, should the unified code system fail of approval and the industry be forced to struggle along under a multiplicity of independent codes, the centralized service of construction through a more adequately organized league would be yet more essential. For in that event the league would be the only agency capable of providing the correlation and unification for which the construction code as now drafted is designed.

NEWS OF THE WEEK

Construction Code Rehearing Reveals Sharp Conflict of Views

Labor union men oppose unification of the industry and demand separate codes and the establishment of skilled as well as unskilled rates.

DEADLOCKED after discussions extending over more than ten weeks since the first code hearing, the construction code and a group of nine supplemental codes were submitted to rehearing on Monday, Nov. 20, at Washington. The principal administrative figures of the NRA, including Administrator Hugh S. Johnson, Divisional Administrator Malcolm Muir, Deputy Administrator Malcolm Pirnie, General Counsel Donald Richberg, and members of the advisory boards, were on the platform.

In an atmosphere made tense by a bitter campaign of newspaper charges during the last fortnight, which included a vicious personal attack against NRA officials in a labor-union paper, an entire day was consumed in argument for and against the codes. The arguments revealed a sharp clash of views of construction employers and labor, the latter opposing a general construction code, demanding the fixing of wage minimums for skilled labor, and asking for a 50-50 share in administration of the codes.

Prime purpose of the rehearing (officially an adjourned session of the previous hearing) was to give opportunity for establishing the representative character of the Construction League of the United States (sponsor of the basic construction code), and the sponsors of the supplemental codes. The latter comprise: General contracting; painting, paperhanging and decorating; electrical contracting; marble setting; plastering; heating, piping and air conditioning; tile and mantel work; metal furring and lathing; and elevator installation. Divisional Administrator Muir presided, but Administrator Johnson frequently took part in the questioning of witnesses.

Codes effectively supported

Testimony offered by the proponents of the codes fully supported the claim that the Construction League as well as the sponsors of the supplementary codes represent majority elements of their several fields. It was brought out that the principal bodies adhering to the Construction League represent the following percentages of total volume of production (estimated generally on the basis of the volume shown by the 1929 construction census) in their own membership and in that of endorsing bodies and units:

	Per cent		Per cent
Architects	80	Building granite	75
Engineers	90	Plumbers	80
General contractors	60	Tile and mantel contractors	75
Painters	75	Plasterers	60
Electrical contractors	68	Masons	51
Marble contractors	76	Metal lathing contractors	90
Heating contractors	65	Arts and crafts	85
Cement gun contractors	83	Elevator contractors	90

Argument on the main questions at issue, principally on the need for a single comprehensive code to stabilize construction and control bad practices, was presented by A. P. Greensfelder, Stephen F. Voorhees, and J. P. Hogan for the League's code committee, A. C. Tozzer and A. E. Horst for the general contractors, W. S. Parker for the architects, Carlton S. Proctor for the engineers, F. H. Holliday for heavy construction, Henry C. Turner for a committee of the principal New York builders, John Lowry for the Mason Builders Association, and leaders of the master painters and decorators, master plumbers, electrical contractors, heating contractors, marble contractors, cement gun contractors, metal furring and lathing contractors, plasterers, sheet metal contractors, for their respective codes as well as the basic code.

Unified construction

Mr. Greensfelder developed in forceful terms the necessity for unification. The League is the only group in America that can speak for unified construction, and rejection of the basic code would shatter the only chance to bring the industry together, he said. The interests of the League and of the employer element of construction are common with those of labor; when the construction industry is idle, labor is idle. He brought out also that building and other engineering structures are carried out by the same men, use the same tools and the same brain and brawn, and that no partisan codes are in order at this time of stress and unemployment. Mr. Voorhees developed the specific procedure followed in drafting the construction code, beginning with the formation of an advisory council on July 31. Pointing out that the product of construction is fixed in location, he showed that its operation cannot be governed from a central point through a central authority but requires local and functional division of control, with final appeal through national code authorities to the Administrator.

Contractors support code

Mr. Tozzer similarly reviewed the activity for a contractors' code, begun even before the Recovery Act was passed, and showed that the code now is supported by more than 5,000 general contractors all over the country, that these have approved the plan of having a general code and a divisional code for general contracting, as well as the codes themselves. In view of the injurious results of two months delay in approving codes, which retards investment in capital goods, he urged that approval be expedited.

Wm. Stanley Parker covered the procedure in drafting the architects code, and Carlton S. Proctor that of the engineers' code, and gave data to confirm the truly representative character of the constituencies. Both professional groups are convinced of the necessity of a basic code for the regulation of the construction industry and uphold the Construction League as a proper representative body. For the engineers, Mr. Proctor said that it was recognized that not all engineers are in construction, but every effort was made to include all groups concerned in this field, in which approximately 80,000 engineers are believed to be engaged.

Daniel C. Webster, for the building division of the general contractors, reviewed the development of the building sub-code from May 25 when the A.G.C. made the first draft of the general contractors' code, to a month later, when the building contractors decided to join with the A.G.C. in formulating a builders' code. A committee representing building contractors of the United States has continuously followed the basic code work, endorses the basic code and will complete the building sub-code as soon as the basic codes are approved.

Henry C. Turner, for a group of large builders in New York, endorsed the Construction League code as bringing the whole industry under one general leadership, setting one standard of fair competition for the whole country, providing for divisional organization to meet particular

New Orleans Bridge Wage Rates Set by National Labor Board

The award of the National Labor Board in the dispute over wages on the Public Belt Bridge at New Orleans was announced on Nov. 15 by Senator Robert F. Wagner, chairman. Work on this bridge, the construction of which is being financed by the R.F.C., was halted by a strike which commenced on July 10 and became general on July 17. The main point in controversy between the workers and the contractors was the question of wages. The board had previously arranged a temporary settlement of the bridge strike under the terms of which the board was to arbitrate the questions at issue.

The award made on Nov. 15 fixes the wage scales, rules on working questions, and provides that any further dispute shall be referred to the National Labor Board. Though this award provides for wage increases, Senator Wagner calls attention to the fact that it is not to be considered as a precedent for the region.

Besides a general increase of 15 per cent for all workers on a monthly basis (not including the management) the award sets a scale of wages running from $1.25 an hour for the highest skilled grade to 40 cents an hour for common labor. No overtime is allowed except in emergencies; such overtime is to be paid at the rate of time and one half. Night work and Sunday work will be paid double time. The award provides that payment of the increases shall be supervised by the Reconstruction Finance Corporation, which is financing the operation, and is retroactive to Aug. 10, when the temporary settlement was reached.

requirements, and offering a sound plan of administration which will coordinate the industry and provide machinery for collective bargaining. John Lowry declared that the Mason Builders Association endorses the Construction League code as coordinating construction and as fair to labor, and stated that any system establishing one code authority for general contractor and sub-contractor is unsound because it brings buyer and seller together.

Specific arguments on hours and wages were presented by Mr. Horst and Colonel Hogan. Mr. Horst showed that because of the seasonal nature of construction and weather interruption, a working week well above the desired point must be fixed, but that in any event the code provides for collective bargaining to fix hours in local agreements. Colonel Hogan similarly presented data from an extended inquiry into current construction wages, showing that the code minimum is well above present average earnings and will increase the workers' weekly income even with the shorter hours fixed in the code.

An NRA statement

For the Industrial Advisory Board of the NRA, R. E. Wood read a prepared statement from the board asserting that there is no possible alternative to a comprehensive code for an industry composed of a great number of divisions, all impinging on each other and all cooperating in the same task, whose various elements share in determining trade practice. The system of codes correlated by a basic code marks the first step in the necessary coordination of the industry. The board endorsed and urged acceptance of the code by the Administrator, described the area agreement provisions as sound in principle, stated that details of administration are secondary at this time and are adequately cared for by provisions for change and improvements, and favored local, regional and national joint boards of employers and employees.

Union labor opposes

Leading the opposition of labor to the codes presented, William Green, president of the American Federation of Labor, declared the basic code less constructive, more open to abuse, and less favorable to labor than the codes of other industries, and claimed that only complete redrafting can bring it into line with the purpose of the Administration. He insisted that construction of buildings and other or "open" construction are essentially different and should be kept separate. He asked for the establishment of a construction industry planning board, to include all elements of construction, in each individual field of construction, as building, open construction, etc., labor to be included in each board as a partner together with realty, finance, professional and contracting interests. M. J. McDonough, president of the Building Trades Department of the Federation, joined in the opposition, declaring himself opposed to all codes that provide for more than 30 hours and all codes that fix a minimum of 40 cents per hour for unskilled labor; he declared that a 40-cent wage would become the legal wage for all construction workers. He denounced the Construction League as aiming to destroy collective bargaining, and charged its code with having sinister objective. Strong opposition to the Federation claims was expressed by J. J. Ryan, for the Amalgamated Association of Bridge, Structural, Ornamental Iron, Bronze Erectors and Affiliated Trades, who charged that unions affiliated with the Building Trades Council had used force against contractors who worked with the steel unions, and stated that the NRA program is not intended for any single group.

A.F.L. opposition was further detailed by Thomas A. Lain, for the bricklayers, who demanded that the PWA rates be set as minimum in the code, especially because these rates have been adopted by the PWA for relief roll men, who obviously will not go off relief work and go with contractors for a lower rate; by E. Bieretz for the electrical workers, who in an hour-and-a-half statement charged that there is no such thing as a general contractor and who demanded that the employer-mechanic be eliminated; by M. J. Colleran, for the plasterers.

Adjustment committee appointed

At the conclusion of the testimony, Chairman Muir announced that the hearing would be adjourned to Nov. 27 and that in the meantime a committee representing different interests would be named by Administrator Johnson to attempt to iron out the differences of view brought to light. The personnel of the committee, later announced, includes:

For the Construction League, Stephen F. Voorhees, A. E. Horst; for the Associated General Contractors, A. C. Tozzer, E. J. Harding; for subcontractor groups, R. D. Williams, Oscar A. Reum, L. W. Davis, H. P. Cole; for labor, William Green, M. J. McDonough; for the NRA, Donald Richberg, Robert W. Lea.

Highway Research Board to Meet In Washington, December 7-8

The Highway Research Board of the division of engineering and industrial research of the National Research Council, will hold its annual meeting at the headquarters of the Council in Washington, Dec. 7 and 8. The tentative program calls for sections devoted to materials, traffic, highway economics, and maintenance and design, in addition to the general session at which there will be a report of the committee on finance and administration, the committee on tractive resistance, and a report of the director, R. W. Crum.

57th St. Bridge at New York Disapproved by War Department

The Secretary of War has declined to issue a permit to the North River Bridge Co. for the construction of its proposed bridge acros the Hudson River in the neighborhood of 57th St., New York. In declining to issue the permit the Secretary of War stated that while the bridge could not be considered as interfering unreasonably with river traffic, if the bridge was badly needed, it was his interpretation of the law that when there is serious question as to the necessity of the bridge any interference with navigation by it is to be considered unreasonable. The Secretary cited the fact that construction of the bridge is opposed by local public authorities, especially the Port of New York Authority, which has begun construction of a vehicle tunnel under the river at 38th St.

B.H.M. Hewett, Tunnel Engineer, Dies Suddenly in England

Bertram H. M. Hewett, engineer in charge of construction of the Mersey Tunnel, between Liverpool and Birkenhead in England, died of heart failure on Nov. 13, at his home in West Kirby, Cheshire, England. Mr. Hewett is best known in this country for his work on the Pennsylvania Railroad tunnels at New York.

Mr. Hewett was born in England in 1874. He began his engineering career in 1896 on the saff of Sir Benjamin Baker and Sir Basil Mott on the construction of the Central London Railway, a shield-tunnel project. Later he was resident engineer on extensions to the City & South London Railway, also tube-tunnel structures, and, subsequently was on heavy underpinning construction and on the installation of ventilation apparatus for the Central London Railway.

After a short time spent in India on survey work, Mr. Hewett was engaged by Charles M. Jacobs, then chief engineer of the North River Division of the Pennsylvania Railroad terminal work at New York, and in 1904 was appointed general resident engineer on the North River Division, including work west of the terminal, the North River tunnels and the tunnels through Bergen Hill. On completion of this work, Mr. Hewett joined the firm of Jacobs & Davies, Inc., and, in 1910, went to India to report on the reclamation of land for the enlargement of the city of Bombay and to report on the construction of railway terminals at Calcutta.

Upon his return from India, Mr. Hewett was for a time on subway work at New York, and then went to Mexico to become managing resident engineer on the construction of an aqueduct tunnel for the Mexican Light & Power Co. Mr. Hewett returned to New York upon the completion of that work in 1913, and continued on subway and tunnel work as a member of the firm of Jacobs & Davies until, in 1925, he accepted the position of resident engineer on the Mersey River Tunnel for the firm of Mott, Hay & Anderson. As noted in our issue of last week, that tunnel project is nearing completion.

Court Decision on Transit Fare Affects New Subway at N. Y.

A decision of the appellate division of the supreme court of the state of New York, rendered on Nov. 11, reverses the decision of a lower court and seriously restricts the city in the use of tax funds to pay interest and amortization on bonds issued to finance construction of the new city-owned subway system.

When the state legislature authorized the city to undertake construction of the new 8th Ave. subway system, it stipulated that the city could collect a 5-cent fare for a 3-year period following the start of service on the line, but that after that 3-year period was up a fare sufficient to carry operating, maintenance, interest and amortization charges must be collected. The lower court had held that the 3-year period would not begin until the entire system was put into operation. The appellate division holds that the period began when the first section of the system was put into operation on Sept. 9, 1932.

Irrigation Projects in State of Utah Get P.W.A. Loan

THREE irrigation projects in Utah were allotted a total of $4,500,000 by the Public Works Administration during the past week. The Deer Creek-Utah Lake project received an allotment of $2,700,000. The project is located on a branch of the Provo River and provides for the construction of a reservoir to augment the water supply of the Salt Lake Valley. The total cost of the project will be $9,974,000. It is considered necessary in order to preserve one of the most highly developed and valuable agricultural districts in Utah. The Moon Lake project received $1,500,000 for the construction of a storage reservoir utilizing a natural lake, to provide supplemental water supply to land near Myton and Roosevelt. An allotment of $300,000 was made to the Sanpete project for the construction of two diversion tunnels. The allotments are made to the United States Reclamation Bureau.

An allotment of $100,000 has been made to the Bureau of Reclamation for the preparation of plans and estimates for the Parker-Gila irrigation project in Arizona. The Boulder Canyon Project Act authorized an appropriation for this purpose but no appropriation was made by Congress. The project contemplates irrigating about 100,000 acres near Parker, Ariz., with water from the Colorado River, and about 250,000 acres in the Gila Valley.

State and municipal projects

Three separate groups of allotments for non-federal projects were announced by the PWA during the past week. A total of 78 projects are covered, and the allotments and grants amount to $19,611,000. Details are given in an accompanying table. These allotments bring the total of non-federal projects up to over 700, and the amount of money allocated to over $46,000,000. Large allotments in the week's list cover a combined loan and grant of $7,300,000 to the Loup River Public Power District, Columbus, Neb., a public corporation created under authority of the state for the construction of a diversion dam on the Loup River, 35 miles of canal with a regulating reservoir and low head and high head generating station, also 225 miles of transmission lines in Platte and Mance counties.

The State Roads Commmission of Maryland received a combined loan and grant of $5,412,000 for road relocation and paving and the construction of bridges and viaducts. The loan will be secured by obligation bonds supported by a portion of the state automobile license fees and revenues from toll bridges.

Federal allotments

Among the allotments to federal departments is $499,125 to the aeronautics branch of the Department of Commerce. Of this amount, $152,600 is for relocation of airway lighting equipment, and the establishment of beacons, completion of landing fields, etc. The Public Health Service has received $25,000 for a study of sewage pollution problems in the Hampton Roads section of the Chesapeake Bay. The Office of National Parks received $17,175 for repairs to the Aztec National Park in New Mexico, and $50,000 has been allocated to a survey of a proposed Green Mountain Parkway in Vermont following the Green Mountain Range from the Massachusetts line to the Canadian Border, a distance of about 220 miles. A sky-line drive is proposed for the project, estimated cost $10,000,000. The National Planning Board has received $250.000 to ascertain the extent to which planning, researches, and surveys are now being made throughout the country and to study and correlate those surveys.

Inspection service

As noted briefly last week, Wm. M. Steele, a civil engineer of New York City, has been appointed head of the Inspection Division of the PWA. His staff will cooperate with the state engineers of PWA and will check upon work being carried out with PWA funds. State engineering inspectors as follows have been appointed: New York, M. E. Gilmore; Ohio, J. B. deHamel; Virginia, K. C. Black; Illinois, C. H. Bauer; North Carolina, C. V. York; Arkansas, C. E. Wyckoff. L. H. Clark is the supervising engineer on the low-cost housing project in Euclid, Ohio, being constructed by the Euclid Housing Corporation through Federal aid.

Lewis P. Mansfield has resigned as finance director of the PWA to return to Prudential Life Insurance Co. P. M. Benton, assistant since August, now acting director, formerly was special adviser to the engineering division of the Reconstruction Finance Corporation. William Zimmerman, Jr., Assistant Commissioner of Indian Affairs, has been named liaison officer between the Civil Works Administration and the PWA to sift suitable projects for transfer to CWA.

DETAILS OF PWA LOANS AND GRANTS FOR NON-FEDERAL WORK

Locality	Loan and Grant or Grant	Type	Man-Months Work Provided	Amount
Charleston, W. Va.	L. & G.	Dormitory	1,296	$400,000
Columbus, Neb.	L. & G.	Dam	22,990	7,300,000
Kenosha, Wis.	L. & G.	Water	900	189,000
North Bennington, Vt.	L. & G.	Paving	90	9,000
Larimore, N. D.	L. & G.	School	128	60,000
Sharkey Co., Miss.	L. & G.	School	30	6,746
State of Md.	L. & G.	Roads	8,580	5,411,866
Birmingham, Ala.	L. & G.	Bridges and canal	14,400	2,000,000
Footville, Wis.	L. & G.	Water	60	30,000
Goshen, N. Y.	L. & G.	Waterworks	800	155,000
Hinsdale, Ill.	L. & G.	Parks	210	44,500
Monroe, Conn.	G.	School	200	14,300
Carlisle, Ark.	L. & G.	Water	270	60,000
Elgin, Ill.	L. & G.	Water	480	82,000
Mansfield, Conn.	G.	School	80	300
Greenwich, Conn.	G.	School	2,380	165,000
New Cumberland, W. Va.	L. & G.	Water	300	63,000
Point Pleasant, W. Va.	L. & G.	Sewage system	850	116,000
Rice Co., Minn.	G.	Court house	300	27,600
Ionia, Mich.	L. & G.	Reservoir	450	70,000
State of Mass., Foxboro	L. & G.	Building	464	117,000
State of Mass., Framingham	L. & G.	Sprinklers	100	40,000
State of Mass., Waltham	L. & G.	Building	160	42,000
Wakefield, Mass.	L. & G.	Water	500	100,000
State of Mass., Bridgewater	L. & G.	Sprinklers	325	97,000
Georgia, Vt.	G.	Bridge	27	2,300
Concord, Vt.	G.	School	45	2,900
Conconino Co., Ariz.	L. & G.	School	54	14,000
Roxana, Ill.	G.	School	25	1,800
Amherst Co., Va.	G.	School	18	1,600
Madison, Wis.	G.	Lights	10	700
Sabine, Ohio	L. & G.	School	84	38,000
Burlington, Vt.	G.	Building	90	8,600
Burlington, Vt.	G.	Water	35	1,600
Burlington, Vt.	G.	Streets	320	16,000
State of Indiana	G.	Roads	1,500	77 000
State of Indiana	G.	Roads	385	28,200
Burlington, Vt.	G.	Dock	40	5,800
Burlington, Vt.	G.	Sewer	240	9,700
Harris County, Texas	G.	Steel shed	585	31,300
Burlington, Vt.	G.	Sidewalks	600	23,000
Burlington, Vt.	G.	Fence	360	2,900
Burlington, Vt.	G.	Lighting	40	3,600
Vandalia, Ill.	G.	Water	40	4,600
Randolph, Vt.	G.	Highway	60	1,700
Linden, Texas	L. & G.	Water	585	50,000
Glen Echo, Md.	L. & G.	Streets	60	16,000
Platteville, Wis.	L. & G.	Sewers	240	33,000
Waterbury, Conn.	L. & G.	Golf Course	600	63,000
Cudahy, Wis.	L. & G.	Sewer System	1,980	350,000
Wellington, Kan.	L. & G.	Sewers	300	83,000
DeWitt County, Ill.	L. & G.	Sewers	700	135,000
Cobden, Ill.	L. & G.	Waterworks	300	70,000
Danville, W. Va.	L. & G.	Reservoir	120	22,000
McKinney, Texas	L. & G.	Water	160	51,000
Varnell, Ga.	L. & G.	School	78	14,285
Honolulu, T. H.	G.	Water	1,170	62,000
Lynchburg, Va.	L. & G.	Water	2,400	600,000
Des Moines, Iowa	G.	Pavement	60	8,800
Lexington, Mass.	G.	Sewer	260	11,000
New Haven, Conn.	G.	Streets	715	39,000
State of Connecticut	G.	Railings	650	25,000
Boulder, Colo.	L. & G.	City Hall	240	80,000
Lincoln County, Minn.	G.	Highways	336	10,000
Carysbrook, Va.	G.	School	185	14,000
Redford, Va.	G.	School	64	5,000
Pittsburg County, Okla.	L. & G.	School	4	515
Goochland, Va.	G.	School	163	12,800
Springfield, Mass.	G.	School	1,275	96,000
Evanston, Ill. (amended)	L. & G.	Reservoir	492	150,000
King County, Wash.	G.	School	280	18,000
Hamilton, Ohio	L. & G.	City Hall	1,500	542,900
Crownsville, Md.	G.	Water Tank & Mains	45	7,400
St. Louis, Mo.	G.	Municipal Auditorium	1,700	137,000
Jefferson City, Mo.	G.	Sewers	210	9,000
Columbia, Mo.	G.	Reservoir	220	15,300
Butler, Mo.	G.	Sewers	62	3,000
Wykoff, Minn.	G.	Water	30	1,400
		Total	78,085	$19,611,012

Filters and Metering Proposed For South District of Chicago

Following two years of investigation, planning and designing, a report has recently been made by the city engineering department of Chicago to the city council recommending a 364-m.g.d. filtration plant and complete metering for the southern third of the city of Chicago. The city would sell $165,000,000 of certificates from 1933 to 1938; in addition a PWA grant of $5,500,000 would be expected. At the end of 1960, when the 20-year certificates would have been paid off, there would remain a surplus of $4,700,000, suggesting the possibility of a reduction in rates after that time. All of these figures relate to the South District system only, without reference to the other two-thirds of the system (central and north side).

As a public health measure filtration is highly essential after 1938 (when the diversion of water from Lake Michigan via the Sanitary District must be reduced to 1,500 sec.-ft.) unless the pollution from 160,000 people in the Calumet region is adequately treated before that time. Chlorine is so rapidly absorbed by certain industrial wastes contributed by the sewage from the Calumet region that it loses its value for disinfection.

Authoritative opinion is that metering should precede filtration; estimates are that it would reduce the consumption to 170 gal. per capita per day. An ordinance recommending universal metering was before the city council last summer with approval of the twenty members of the finance committee, but though only six more votes were needed to make it effective politics held the ordinance off the floor. The alternative to waste prevention and filters is a more expensive tunnel extension and pump installation. This alternative would still leave the south district with the poorest quality water in Chicago.

The estimated costs are as follows: Metering, 143,000 meters, $5,140,000; lake structures, including breakwater, intake, retaining wall and intake tunnel, $2,600,000; three 128-m.g.d. filter units with low-lift station and 30-m.g.d. filtered water reservoirs, $11,500,000; land tunnels for delivering water to Southwest land tunnel system and two new 40-m.g.d. pumps at both Roseland and 68th St. pumping stations, $1,900,000; total $21,140,000. The proposed site is off the lake shore north of 67th St. on present underwater lake bed conveyed by the state to the South Park Commission.

On Nov. 14 the city council voted to request a loan and grant from PWA to build the filtration plant, leaving the waste prevention program for later consideration. Omission of metering will mean a material increase in size of filter plant capacity, and in consequence Oscar Hewitt, commissioner of public works, roughly estimates the fourth planned unit would have to be constructed at once, increasing the cost of filters to $20,000,000. This sum is named in an ordinance authorizing the issuance of water certificates, which will be the collateral sold to PWA for the portion over the grant of 30 per cent of material and labor costs.

The report was prepared under the general direction of Myron B. Reynolds, city engineer, by Arthur E. Gorman, filtration engineer.

Federal Housing Gets Allotment of $100,000,000

The PWA has allotted $100,000,000 to the Federal Emergency Housing Corporation, for slum clearance and low-cost housing. The first project will be in Detroit and others are planned in about twenty cities. Three to four million dollars will be spent in Detroit to provide $6.30 per month rooms. This project is to serve as a demonstration of what the federal government can do, said Harold M. Ickes, president of the housing corporation and PWA Administrator. It will consist of two-story fireproof houses providing 2,900 rooms and accommodating 2,500 persons. The Detroit work will be undertaken on condition the city asks the legislature to create a state housing commission with authority to take over projects financed by grant and PWA loan and secured by revenue bonds. The Detroit common council has made a request to the governor for such legislation. Operation of the project will be managed by the Federal Housing Corporation until the state authority is set up. The amortization period is 35 years, with the federal government benefiting until reimbursed.

Work will begin on one or two sections as soon as the corporation is satisfied that land can be acquired at prices permitting low rental. The proposed location is close to the downtown district and is now occupied largely by negroes. Initial plans call for razing ten or twelve city blocks and erecting hollow rectangles or quadrangles with an average of 28 dwellings each.

Chicago Sanitary District Accepts Large Loan Contract

Contracts with PWA were accepted Nov. 13 by the Sanitary District of Chicago to furnish funds with which to complete five contracts totaling $8,000,000. These contracts were stopped in February 1932 because the district was unable to sell its bonds in the open market. The acceptance followed several days sessions in Chicago between Lloyd H. Landau, solicitor for PWA and Sanitary District officials. Because the district is in default, the 30 per cent grant allowed will not be paid on monthly estimates as is usual but will be held until the work of each contract has been completed. As the bonds of the district have already been issued and bear 4½ per cent, PWA is taking them at 4 per cent and will make refund for the ½ per cent.

The contracts are for pump and blower house at Calumet, two batteries of contact tanks at Calumet, a battery of Imhoff tanks at the west side plant, half completed, and two sections of west side intercepting sewer tunnels.

The PWA will assume no risks, damages or expense that may accrue to the contractors by reason of the delays due to lack of funds. In consequence the old contracts hold and have had to be confirmed by the contractors holding them. Most of the contractors have accepted the new conditions and are ready to go ahead despite the fact that cement (bulk) was contracted for two years ago at 80c. and other commodities at similar low figures.

Am. Road Builders Association To Meet in Chicago in January

The 31st annual convention of the American Road Builders' Association will be held in Chicago, during the week of Jan. 22, 1934. In connection with the convention the association will hold a representative exhibit of highway equipment and materials. The meeting will discuss:

The need of continuation of an adequate highway program.

The necessity for federal participation in the nation's road program.

The use of highway revenues for the extension and improvement of the nation's highway network.

The necessity for bringing back to the highway program gasoline and motor license revenues which, during the period of economic stress, have been diverted to other purposes.

The program will stress the necessity of coordinated action to stop the inroads upon highway funds. The nation's highway development in the past three years —in spite of the $400,000,000 emergency public works road program—has fallen below a standard that gives reasonable assurance of meeting the needs of motor transportation. Diversion of motor revenues in many of the states, of an amount estimated at $200,000,000 this year, has cut tremendously into the road programs of these political subdivisions.

Welded Oil-Storage Tank Failed Under Heavy Test Load

Preliminary studies of the failure of the welded oil tank at the North Tiverton, R. I., storage plant of the New England Terminal Co., two weeks ago reveal the series of events that led up to the disaster. The tank, of 80,000-bbl. capacity, about 115 ft. in diameter and 50 ft. high, was completely arc welded in the field. As a test for tightness and structural adequacy, it had been filled with salt water to within about 1 ft. of the top. Because the specific gravity of salt water is materially higher than that of oil, the test was an extreme one. Some leaks developed, and men were at work calking the minor ones and welding the larger ones, when the tank collapsed, releasing the salt water. The rush of this water evidently broke oil lines whose discharge was ignited from sparks of unknown origin. The resulting fire destroyed adjacent oil storage tanks, causing damage estimated at $800,000, and several fatalities occurred.

Although there is no direct evidence as to the exact point of initial failure in the tank, it is believed by some to have been in a vertical seam of the shell. As failure progressed, the tearing of the plates continued without apparent relation to the location of the welds. According to press reports suit has been brought by the oil company against the Graver Corp., fabricator of the tank, charging defective welding. Some calculations are said to show that some of the steel was stressed to 22,000 lb. per sq.in. under the test load. Such stresses, however, are not unprecedented, in riveted oil-tank practice at least, where safety factors as low as 2½, based on 55,000-lb. steel, have been used. No evidence of serious settlement of the tank foundations has been presented, which would tend to eliminate this as a cause of the failure.

New Specifications for Steel Approved by A.S.T.M.

The American Society for Testing Materials has approved for publication as tentative three new specifications covering steel for bridges, for buildings, and for plate work. The new specifications for bridge and for building steel (A7-33T and A9-33T respectively) call for 60,000 to 72,000 lb. per sq.in. tensile strength as against 55,000 to 65,000 previously required. The tentative specification for the softer grade of plate steel (A10-33T) retains the old strength and yield point values, namely 55,000-65,000 and 30,000 lb. per sq. in.; this steel is comparable to the existing standard structural grade.

The new specifications for steel for bridges and buildings follow in general the requirements given in the medium structural steel specifications issued last year. There are, however, a number of changes. Rolled base plates over 2 in. in thickness, for bearing purposes, must be open-hearth or electric-furnace steel, 0.20 to 0.35 carbon. In addition to the higher ultimate strength requirement the minimum yield point required for steel under both these specifications is 0.5 the tensile strength, but in no case less than 33,000 lb. per sq.in. as against 30,000 at present. The minimum per cent elongation in 8 in. for bridge steel is 1,500,000/tensile strength, while the compared figure for building steel is 1,400,000/tensile strength. However, a deduction of 0.25 per cent can be made for each increase of $\frac{1}{32}$ in. of the specified thickness or diameter above $\frac{3}{4}$ in., to a minimum of 18 per cent for plates, shapes and bars in bridges and to 16 per cent for buildings.

Steel for bridges must be made by either or both the open-hearth or electric-furnace process, while steel for buildings may be made by one or more of the following processes: open-hearth, electric-furnace or acid-bessemer, except that the latter cannot be used for plates and shapes over $\frac{7}{8}$ in. which are to be punched.

In general the new specifications require two tension and two bend tests from each melt instead of the one test formerly specified. The bridge specification covers steel for eyebars and requires a tensile strength range for unannealed flats of 67,000 to 82,000 lb. per sq.in. The yield point for this material must be not less than 36,000 lb. per sq.in. In some cases full-size tests for finished annealed eyebars are required, in which case the specifications require a minimum tensile strength of 60,000 lb. per sq.in. and a minimum yield point of 33,000. In these full-size tests, the minimum elongation in 18 ft. is given as 12 per cent.

The actual preparation of the specifications was carried out by subcommittee II on structural steel for bridges, buildings and rolling stock under the chairmanship of A. W. Carpenter, engineer of bridges, New York Central R.R.

Chicago District Offices of U. S. Army Engineers Merged

On Nov. 16 the First and Second Chicago District offices of the U. S. Army Engineers were merged into one district to be known as the Chicago District. The address is 333 North Michigan Ave., Chicago. Lt. Col. Dan I. Sultan is the district engineer.

SOCIETY CALENDAR

AMERICAN ROAD BUILDERS ASSOCIATION, annual convention, Chicago, Jan. 22-26, 1934.

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual meeting, New York, Jan. 17-20, 1934.

AMERICAN TOLL BRIDGE ASSOCIATION will hold its annual convention at Cincinnati, Ohio, Jan. 26-27.

HIGHWAY RESEARCH BOARD, National Research Council, Washington, D. C., Dec. 7-8.

A CHARLESTON CHAPTER of the West Virginia Society of Professional Engineers has been organized with C. P. Fortney, former state highway engineer, as president, J. E. Settle vice-president, and R. S. Simpson secretary-treasurer.

INDIANA SECTION, American Water Works Association, will hold its meeting, postponed last spring, Dec. 6 and 7 in Fort Wayne, following dedication of the Fort Wayne water purification and softening plant on Dec. 5. Scheduled are round table discussions on collections, meter maintenance, good will and increasing revenue, also papers on use of relief labor, soft water, fire protection and phases of the PWA program. C. K. Calvert, Indianapolis, is secretary.

PHILADELPHIA SECTION, American Society of Civil Engineers, at its meeting on Nov. 15 was addressed on the subject of the New Jersey Meadows Viaduct and the Golden Gate Bridge. Speakers were W. H. Ellis, of the Phoenix Bridge Co., who described the 3-mile viaduct extending over the New Jersey Meadows from the Jersey City approach to the Holland Tunnel to Elizabeth. The Golden Gate Bridge was described by E. F. Ball, of the McClintic-Marshall Co. B. F. Hastings, district engineer of the American Institute of Steel Construction, presided.

CONSULTING MUNICIPAL ENGINEERS of the Central Region met Nov. 6 in Chicago to form a loose organization of the above name to protect their interests in the matter of the proposed code under the NRA and to prevent unfair competition and practices under the code. Another meeting to perfect the organization was held Nov. 13. A letter was ordered sent to the framers of the proposed engineers code protesting against the inclusion of the temporary "fee" clause which refers to the schedule set up by the American Society of Civil Engineers. If this clause goes into effect numerous municipalities will not employ any consulting engineers was the contention.

METROPOLITAN SECTION, American Society of Civil Engineers, at its meeting held in New York on Nov. 15 was addressed by James K. Finch, Renwick Professor of Civil Engineering at Columbia University on the subject of engineering and the graphic arts. Using drawings of old engineering work, Professor Finch discussed the development of the reproduction of drawings by woodcut, etching, engraving, etc. In discussion, Thaddeus Merriman, president of the section, added other illustrations including a slide showing the woodcut that at one time was used as the masthead for *Engineering News*. A special appeal was made at the meeting for clothing for the Professional Engineers Committee on Unemployment which maintains a clothing depot in the McGraw-Hill Building, 330 W. 42d St., New York.

Bids Called for Earthwork on All-American Irrigation Canal

The U. S. Bureau of Reclamation, through its office at Yuma, Ariz., is calling for bids on the earthwork for the first section of the All-American Canal in Southern California. The section now under bid is a short section, mostly along the international boundary line to the west of the Colorado River below Yuma. A total of about 4,000,000 cu.yd. of earth and 500,000 cu.yd. of rock excavation is involved. Bids are to be opened on Dec. 4.

General Contractors Urge Adoption of Construction Code

Condemnation of the increasing tendency of governmental agencies to revert to "day labor" methods in carrying forward construction under the recovery program; a plan for the establishment of more economic wage scales by the Public Works Administration; and an urgent appeal for immediate adoption of the proposed code of fair competition for the construction industry, were embraced in resolutions adopted by the governing board of the Associated General Contractors of America, which met Nov. 13 and 14 at Washington, D. C.

The board called upon all public agencies to utilize private industry to the greatest possible extent in the supplying of construction services, contending that the work can be performed more economically and efficiently under the contract system than by day labor and that the contract system can offer equal employment opportunities.

Following demands by John W. Cowper, of Buffalo, former president of the association, that means be found for attracting private capital back to work in the capital investment field, the board adopted a resolution urging that the Public Works Administration take the lead in setting an economically justifiable construction wage scale by downward revision of its present rates.

The board placed in formal nomination N. F. Helmers, president of Seims-Helmers, Inc., St. Paul, to succeed A. C. Tozzer, of New York, as president of the Associated General Contractors for the coming year and A. W. Merchant, of Providence, R. I., was nominated as national vice-president-at-large. Nominations are equivalent to election.

Regional Sewage Treatment Discussed at Providence

The long-range advantages of regional treatment of sewage as illustrated in the proposed Rhode Island development were discussed before the Providence Engineering Society and local section of the A.S.C.E. on Nov. 10 by George W. Fuller, consulting engineer on this project. Eighteen cities and towns including Providence are concerned. After outlining the plan as tentatively developed by Mr. Fuller and Thomas F. Bowes, New York, for the Metropolitan Sewer Commission, the speaker pointed out that at the Prudence Island plant no nuisance would be created on the island and the cleared fluid would be chlorinated and discharged into Narragansett Bay. Sludge would be either dried and burned, or taken to sea by barges and discharged at least 18 miles away. The most economical method of dealing with bay pollution, Mr. Fuller said, would be through a metropolitan system adequate to cope with industrial waste as well as with domestic sewage from municipalities, many of which have no sewerage system at present. While regional plants are more costly than smaller local plants at the outset, the former do not involve supersession.

Commenting on the Providence sewage disposal works, now being remodeled to provide activated-sludge treatment, Mr. Fuller said that this installation represents a suitable permanent solution for treatment of sewage and wastes.

Personals

J. F. KEELER has been appointed sales engineer for Steel and Tubes, Inc., with headquarters in the Cleveland office of the company.

E. E. ELAM, assistant engineer of the Orleans Levee Board, New Orleans, La., has been appointed manager of the new Shushan Airport at that city. The airport is now in final stages of completion.

P. N. LIBBY, of Gray, Maine, formerly chief draftsman and assistant to construction manager with E. B. Eddy Co., Ltd., of Hull, Quebec, is now in the mechanical engineering department of the Tennessee Eastman Corp. of Kingsport, Tenn.

HARRY R. PROSSER, of New York City, formerly associated with the Meehan Paving & Construction Co., P. T. Cox Contracting Co. and the William F. Kenny Co., is now an examining engineer with the Public Works Administration at Washington, D. C.

WILLIAM C. KENDRICK, civil engineer, has been appointed town manager of Norwood, Mass., succeeding Clarence A. Bingham. Mr. Kendrick was born in Brookline, Mass., and was graduated from the Catholic University at Washington, D. C., in 1922 as a civil engineer.

L. T. POWERS has resigned his position as engineer of surveys and plans for the Missouri state highway department to become senior design engineer of the U. S. Bureau of Public Roads, Washington, D. C. He will be succeeded in his old position by Samuel M. Rudder.

GENE N. BURRELL, of Birmingham, Ala., has been appointed hydrographic engineer by the Tennessee Valley Authority. Mr. Burrell has been with the Corps of Engineers in the St. Louis office during the past two years.

JAMES A. DAVIS, district engineer of the Washington state highway department, has been named construction engineer to succeed Eugene Hoffman, who resigned the post three months ago to become chief engineer for the state advisory board of public works.

HOWARD S. GAY, of Westfield, N. J., principal hydroelectric engineer, War Department, who recently completed reports on several New England streams regarding flood control, power development, water supply and navigation, is now an engineer examiner with the Public Works Administration at Washington, D. C.

WILFRED M. HALL, of New York City, has been appointed engineer in charge of construction of Dam No. 3 on the Tennessee River, 16 miles above Muscle Shoals. Mr. Hall was in charge of building the Candlewood dam near Danbury, Conn. He also built two dams in northern New York near Croghan. He then went to Brazil to supervise the construction of a dam north of Bahia.

Obituary

ALFRED A. SMITH, a civil engineer connected with the Baltimore & Ohio Railroad for the last 12 years, died at his home in Port Richmond, Staten Island, N. Y., on Nov. 16 at the age of 75.

CHARLES V. CUMMINGS, 53, vice-president of the Northern Construction Co., Ltd., Vancouver, B. C., died recently in Palm Springs, Calif. He was associated with A. C. Mackenzie and A. R. Mann in the founding and subsequent development of the Northern Construction Co.

H. STRUCKMANN, president of the International Cement Corporation, died on Nov. 17 in Copenhagen, Denmark, while on an extended business trip. Mr. Struckmann was born in Denmark in 1878, was educated as a mechanical engineer and came to the United States in 1902, becoming superintendent of the Nazareth Portland Cement Co., Nazareth, Pa., in 1904. His connection with the International Portland Cement Co. began in 1917 and two years later he was elected president of the International Cement Corporation organized to take over the three foreign units then owned by the International company, together with the domestic companies of the Texas Portland Cement Co. and the Knickerbocker Portland Cement Co. Men in the cement industry looked upon Mr. Struckmann as one of the strongest and most clear-sighted men in the entire field.

CONSTRUCTION STATISTICS OF THE WEEK

HIGHWAY LETTINGS amounting to $15,944,000 helped raise the total of the week's contracts to $37,190,000, the third highest week of the year, despite the falling off of federal contracts from the level maintained for the past few weeks. Federal awards were $8,100,000, slightly more than half the previous week's total. For the first time in several weeks heavy federal lettings of levee work were missing. Lock 7 on the upepr Mississippi at Dresbach, Minn., was the heaviest government contract of the week, $1,320,000. Over four millions in state and municipal contracts other than roads were let, evidence of increasing activity in this class of work. Private contracts, while the heaviest in weeks, $8,900,000, consisted mainly of a single contract for a group of housing and store projects in Newark, Irvington and Hillside, N. J., amounting to $7,200,000. New York led in highway lettings, with contracts aggregating $2,670,000, with Illinois following with $1,582,000.

CONTRACTS
(Thousand of Dollars)

	Week Nov. 23, 1933	Average Prev. 4 Weeks	Week Nov. 24, 1933
Federal Government	$6,269	$12,339	$ 8,140
State and municipal	15,479	11,776	20,099
Total public	$21,748	$24,115	$28,239
Total private	3,363	4,350	8,951
Week's total	$25,111	$28,465	$37,190

Cumulative to date:
1932.....$1,115,949 1933.....$941,888

NEW PRODUCTIVE CAPITAL
(Thousand of Dollars)

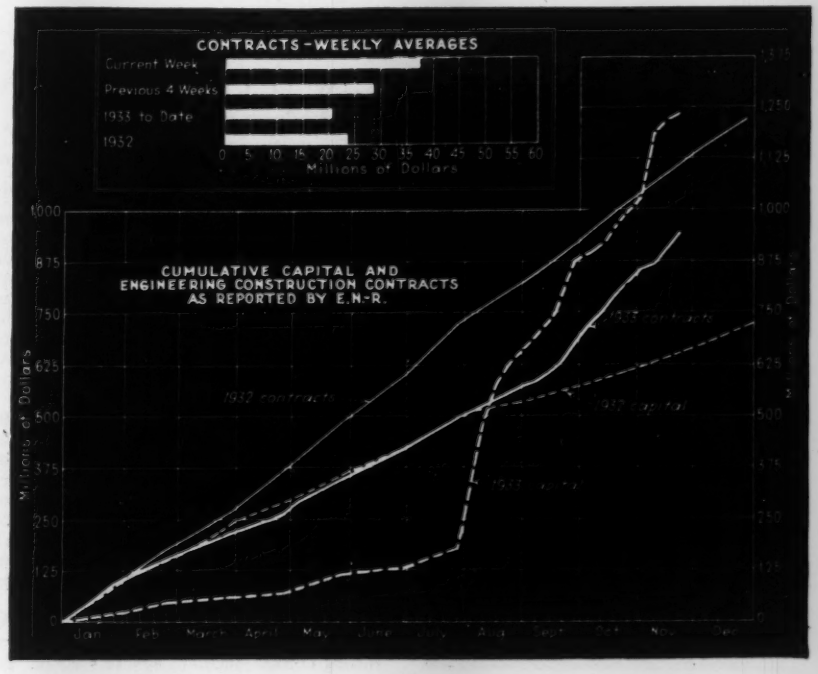
	Week Nov. 23, 1933	Cumulative 1933
State and municipal	$1,167	$270,836
PWA allotments, public	19,549	728,444
Corporate issues	1,250	50,272
PWA allotments, private	....	185,607
Total new capital	$21,966	$1,235,186

Cumulative, 1932.. $653,000

NOTE: These figures include private bonds and stock sold for productive purposes; state and municipal bonds for construction; R.F.C. advances for self-liquidating loans PWA loans and grants to states and municipalities, including the special highway funds; and PWA private loans.

INDEX NUMBERS

E.N.R.-Cost		E.N.R.-Volume	
November, 1933	190.14	October, 1933	162
October, 1933	187.74	September, 1933	122
November, 1932	158.20	October, 1932	137
1932 (Average)	156.97	1932 (Average)	127
1931 (Average)	181.35	1931 (Average)	220
1930 (Average)	202.35	1930 (Average)	260
1913 (Average)	100		

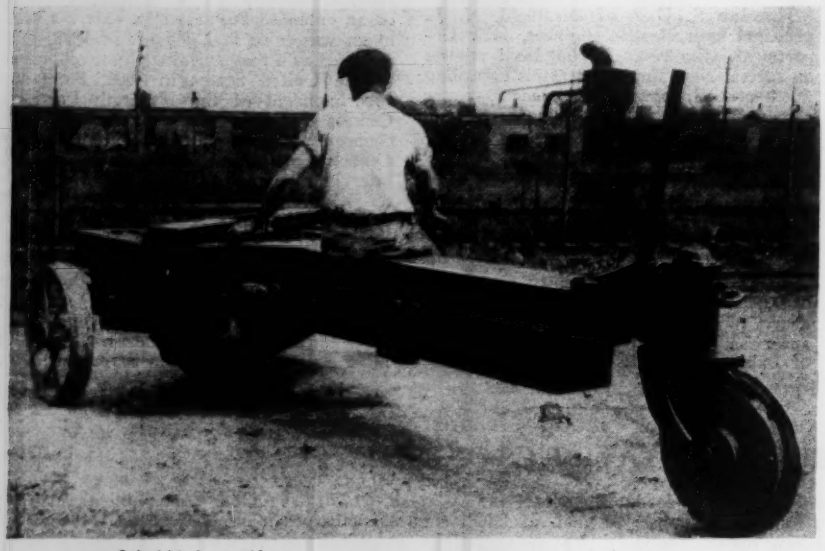


Construction Equipment and Materials

Scarifier Uses Spiral Blade

A new scarifier, entirely unique in principle, has just been placed on the market by the Moritz-Bennett Corp., Effingham, Ill. It employs a spiral for scarifying.

The spiral has an auger-like action when in rotating contact with the ground surface. Because of this action it digs in to the desired depth as regulated by mechanical controls; it cuts off a smooth bottom surface at that depth; and it chews up, turns over, and thoroughly mixes the cut material.



Spiral-blade scarifier.

Pneumatic-Tired Wagon For Earth Hauling

By equipping dirt-hauling wagons with low-pressure balloon standard truck tires on a rocking beam and caster chassis, a levee contractor at Tunica, Miss., is obtaining larger pay loads and speeding up his operations, attaining speeds up to 20 miles per hour. The tire equipment has a useful life of 25,000 to 30,000 miles and weighs 1,500 to 3,000 lb. less than the usual crawler equipment. The four Timken roller bearings are protected and kept out of the sand or muck. Ground clearance is 6 in. more on an 8-yd. wagon, giving additional clearance dumping space. Impact of a dropped load from an excavating bucket is largely taken up by the cushioning effect of the tires.

Turning is effected by pivoting on either front wheel and the two rear wheels caster, eliminating strain on the chassis or wagon. A special device controlled by the tractor driver locks the caster wheels for backing.

Pneumatic tires on a rocking-beam-and-caster chassis permit heavier loads and high speed.

The chassis can be fitted to the stub axle of any standard crawler wagon. The new equipment is manufactured by the Goodman Manufacturing Company, Chicago, for the E. H. Anderson Equipment Company, Chicago, the selling agency. It was developed by E. H. Anderson.

Arc-Welded Boulder Trap Has Unique Design

Unique in both construction and application, a huge dredging boulder trap of arc-welded construction was completed recently by The Graver Tank and Manufacturing Corporation of Chicago. The unit was built for use on the suction line of a large dredge to be used on the Cape Cod Canal.

The trap shown in the accompanying illustration is installed directly in the bottom of a large sea-going dredge. The trap door at the bottom of the ball opens through the hull of the boat directly into the ocean.

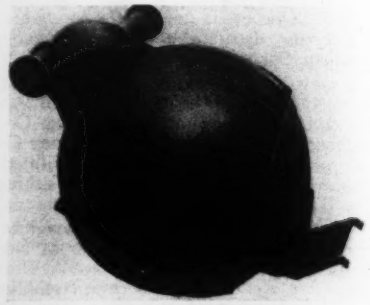
At the upper portion of the large 18-ft. ball there is a 5-ft. sphere which acts as the intake and outlet attachment for the regular dredge line. This smaller sphere contains in its interior a large grill or grizzly which serves to separate from the incoming stream of dredge material all boulders and other bulky objects of a size too great to be passed by the pump on the dredge proper.

In operation, the screen of incoming materials from the cutter head is drawn through this smaller sphere where the larger particles are screened out and dropped into the main ball below. Whenever the accumulation of these larger lumps is sufficient to fill the larger ball, the vessel is disconnected from the dredge line, runs out into deeper water, the bottom dropped, and the load of boulders spilled into the open sea, after which the trap door is again closed and the dredge returns to its point of operation.

The unit operates under a vacuum of 15 lb.

Heavy steel plate was used for the trap. The shell plates of the large sphere are 1¼ inches thick. The entire unit was assembled by arc welding. On account of the large size, it was necessary to fabricate all of the units in the shop and deliver them directly to the shipyard where the final assembly was made.

The total weight of the entire unit is 31 tons.



Trap to remove rocks and boulders from the suction line during dredging operation. It is built of arc welded steel and weighs 31 tons.

New Publications

Power Shovel. The Keystone 1-yd. model 18 shovel, crane, skimmer, and pullscoop is described in detail in a new 41page catalog issued by the Keystone Driller Company, Beaver Falls, Pa.

Pipe. In a 63-page booklet, Taylor Forge and Pipe Works, Chicago, Ill., describe the advantages, manufacture, use and specification, weights, prices of pipe—also are included descriptions, specifications, and prices of joints, elbows, couplings, fittings for spiral pipe. Six pages are devoted to charts, tables and formulae for the flow of water through pipes.

Wire Rope. A. Leschen & Sons Wire Rope Co., St. Louis, Mo., have issued a revised edition of their booklet entitled "Practical Information on the Use and Care of Wire Rope." This booklet contains 36 pages of information on selection, care, handling, splicing of rope, and information on the design of slings, guys, and cable spans, and includes an index.

Compressors. The Worthington Pump & Machine Corp., Harrison, N. J., have just published two bulletins describing their compressors. One, a 7-page booklet, deals with the features of their 120 cu.ft. displacement portable compressor; the other, a 16-page booklet, deals with the line of compressors which they manufacture for refrigeration, describing in detail with illustrations the special design and typical installations of these compressors.

Structural Shapes and Piling. The Inland Steel Company, Chicago, Ill., has just published a new booklet on bars, shapes, plates, and semi-finished steel entitled "Sizes We Roll and Standard Extras," incorporating all up-to-date changes in extras, and tolerances and size data on the company's bar, plate, and structural wire products. They also have published a new catalog on Inland Steel Sheet Piling, giving engineering information on their complete line of sections, together with essential data for design and construction work. It also pictures important recent projects constructed with Inland Sheet Piling.